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FM 6-55

DEPARTMENT OF THE ARMY FIELD MANUAL

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**4.5-INCH MULTIPLE
ROCKET LAUNCHER
M21, TOWED**

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4.5-INCH MULTIPLE ROCKET LAUNCHER M21, TOWED

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CHAPTER 1

GENERAL

1. Purpose and Scope

This manual is a guide to assist commanders in developing the sections of towed 4.5-inch multiple rocket launcher M21 (T123) firing batteries into efficient, smooth-working teams that have a sense of discipline that will impel them to operate effectively under the stress of battle. It prescribes individual duties and section drills, inspection and maintenance drills, tests and adjustments for sighting and fire control equipment, and methods for the destruction and decontamination of equipment.

2. Definitions and Terms

a. Section. Tables of organization and equipment prescribe the *personnel* and *equipment* comprising each section of a battery (figs. 1 & 2). In this manual the term *section* is often used to designate *only the personnel* required to serve the launcher and equipment of one section.

b. Coupled. A launcher is coupled when it is attached to its prime mover.

c. Uncoupled. A launcher is uncoupled when it is detached from its prime mover.

d. Front. For the purpose of conducting drills prescribed herein, the front of a section, launcher coupled, is the direction in which the prime mover is headed; launcher uncoupled, the front is the di-

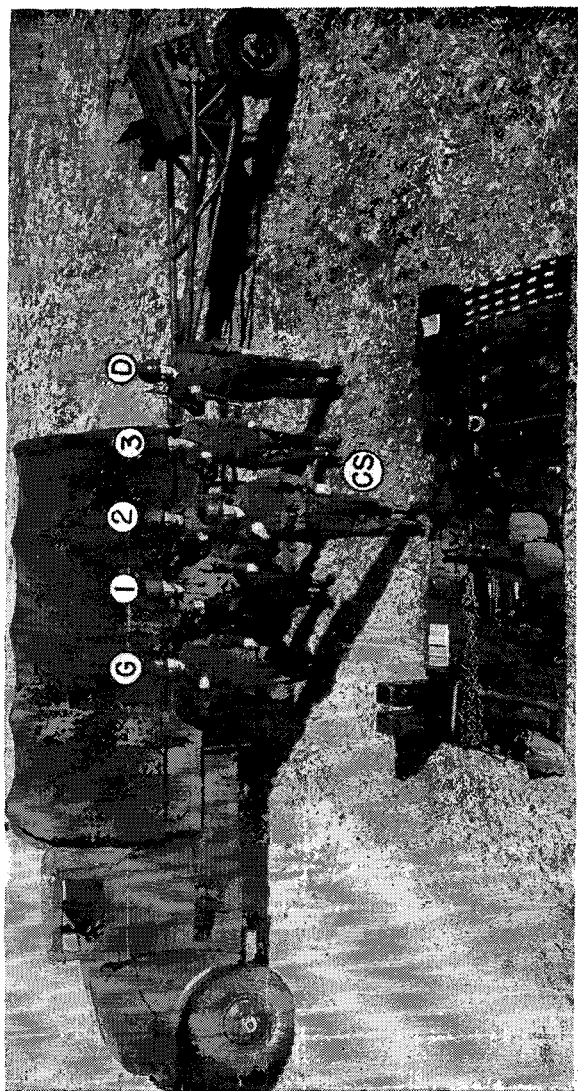


Figure 1. 4.5-inch multiple rocket launcher section, towed.

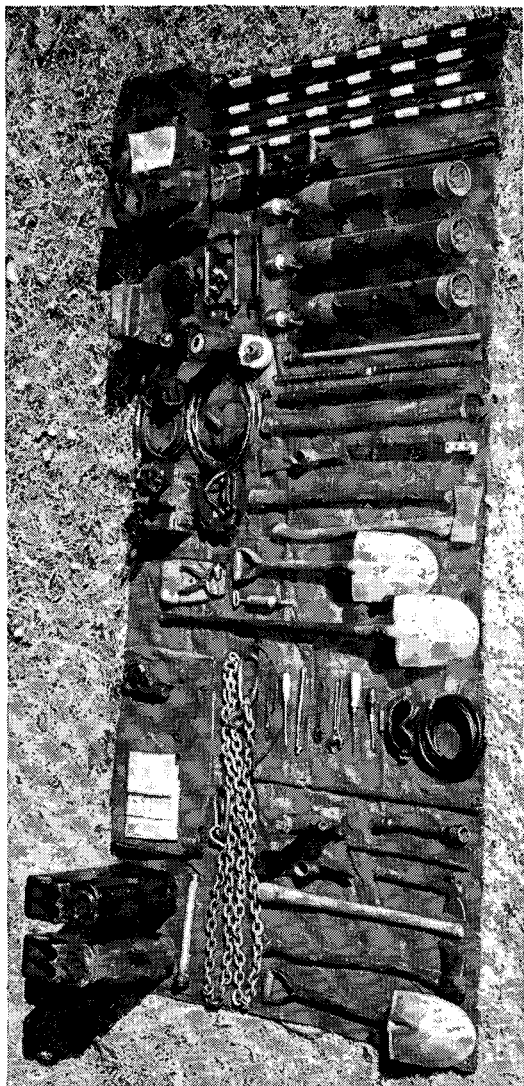


Figure 2. A method of displaying section equipment.

rection in which the tubes point. However, for determining the right or left of the *launcher*, coupled or uncoupled, the front is the direction in which the tubes point.

e. Right (left). The direction right (left) is the right (left) of one facing to the front.

3. References

Publications pertaining to the 4.5-inch multiple rocket launcher M21, and auxiliary equipment, covering related matters not discussed in detail in this manual are listed in appendix I.

CHAPTER 2

ORGANIZATION

4. Composition of the Launcher Section

a. The launcher section consists of section personnel, a 4.5-inch multiple rocket launcher M21, the prime mover, and auxiliary equipment.

b. The personnel of the launcher section consists of—

- (1) A chief of section (CS).
- (2) A gunner (G).
- (3) Three rocketeers, numbered from 1 to 3 inclusive (No. 1 is the assistant gunner).
- (4) A driver (D).

c. Section equipment is listed in T/O & E 6-87 and appropriate SNL's as listed in the appendix.

5. General Duties of Personnel

a. Chief of Section. The chief of section is the noncommissioned officer in command of the entire section and is responsible to the platoon commander for—

- (1) Training and efficiency of personnel.
- (2) Performance of duties listed under section drill, duties in firing, testing and adjustment of sighting and fire control equipment, and inspection and maintenance of all section equipment, including the prime mover.
- (3) Observance of safety precautions.

- (4) Preparation of field fortifications for protection of equipment, ammunition, and personnel.
- (5) Camouflage discipline; local security; and radiological, biological, and chemical security discipline.
- (6) Maintenance of the gun book.
- (7) Police of the section area.

b. Gunner. The gunner is the assistant to the section chief in carrying out the duties specified in *a* above. The gunner's specific duties are prescribed in the appropriate chapters of this manual.

c. Rocketeers. Rocketeers perform duties as listed in this manual, and any other duties that the chief of section prescribes.

d. Driver. The driver's primary duty is the driving of the prime mover of the section. He also performs maintenance and such other duties as are prescribed by this manual, by the technical manual for the vehicle, or as may be prescribed by the chief of section.

CHAPTER 3

SECTION DRILL

Section 1. GENERAL

6. Objective

The objective of section drill is the attainment of efficiency—maximum precision coupled with high speed.

7. Instructions

a. To develop maximum efficiency and to prevent injuries to personnel and damage to equipment, the drills prescribed in this manual must be observed. Section drill should be conducted in silence except for commands and reports. The section must be drilled until reactions to commands are automatic, rapid, and efficient.

b. Mistakes are corrected immediately. Each member of the section must be impressed with the importance of reporting promptly to the chief of section any mistakes discovered after the command to fire has been given. The chief of section will report mistakes immediately to the platoon commander.

c. Battery officers supervise the drill to insure that instructions are carried out and that maximum efficiency is obtained.

d. Duties should be rotated during training so that each member of the launcher section can perform all the duties within the section. In addition, battery

overhead personnel not assigned specific duties during drill periods should be trained in the fundamentals of section drill in order that they will be capable of functioning efficiently with a launcher section if required.

Section II. PRELIMINARY COMMANDS AND FORMATIONS

8. To Form the Section

a. To Fall In. The chief of section takes his post. On the command of execution the section forms in a single rank at close interval, centered on and facing the chief of section at a distance of 3 paces. Higher numbered rocketeers, if present, form in order between No. 3 and the driver. The chief of section may indicate in his preparatory command the place and direction the section is to form. At the first formation for a drill or exercise the caution "As launcher section(s)" precedes the command. The commands are: FALL IN, or 1. IN FRONT (REAR) OF YOUR LAUNCHER(S), 2. FALL IN; or 1. ON THE ROAD FACING THE PARK, 2. FALL IN. Execution is as follows: The launcher section moves at double time and forms at close interval, at attention, guiding on the gunner.

b. To Call Off. The section being in formation, the command is CALL OFF. At the command all personnel in ranks except the gunner execute eyes right. The section then calls off in sequence, "Gunner," "1," "2," "3," "Driver." As each man calls out his designation he turns his head and eyes smartly to the front.

9. Posts of the Section

The command is 1. ROCKETEERS, 2. POSTS. The command is general and is applicable whether the section is in or out of ranks and at a halt or marching. All movements are executed at double time and are terminated at the position of attention. Higher numbered rocketeers, if present, take posts as prescribed by the chief of section.

a. Launcher Coupled. The section moves to posts as shown in figure 3. All personnel face to the front and are alined 2 feet outside of and parallel to the sides of the prime mover.

b. Launcher Uncoupled, Not Prepared for Action. The section moves to posts as shown in figure 4. All personnel face to the front and are alined 2 feet outside of and parallel to the wheels, except for the chief of section who stands 3 paces to the rear of the trail.

c. Launcher Prepared for Action. The section moves to posts as shown in figure 5. All personnel face to the front except the chief of section who faces the executive unless otherwise indicated.

10. To Change Posts

To acquaint the members of the section with all duties and to lend variety to drill, posts should be changed frequently. The section being *in formation* the commands are 1. CHANGE POSTS, 2. MARCH, or 1. SECTION, CHANGE POSTS, 2. MARCH.

a. At 1. CHANGE POSTS, 2. MARCH, all numbered rocketeers except No. 3 (or the highest numbered rocketeer) take two left steps thus placing them at the post of the next higher numbered rocketeer. No. 3 moves at double time in rear of the sec-

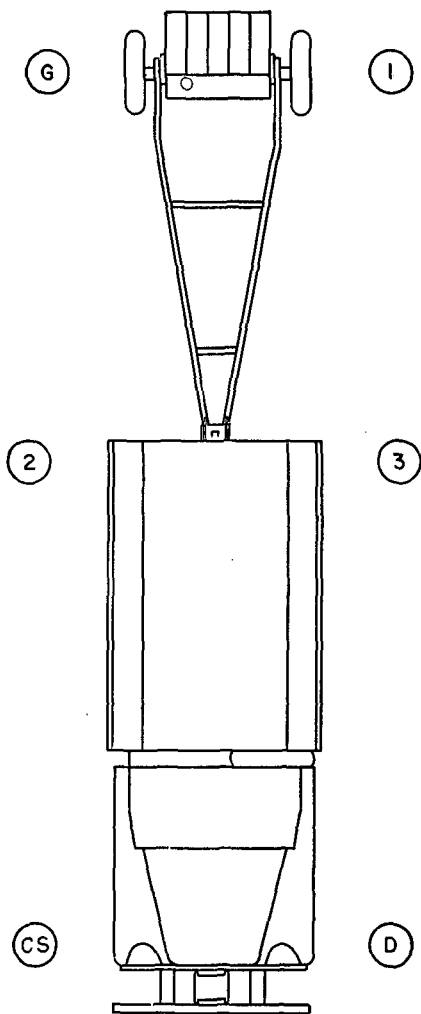


Figure 3. Posts of section, launcher coupled.

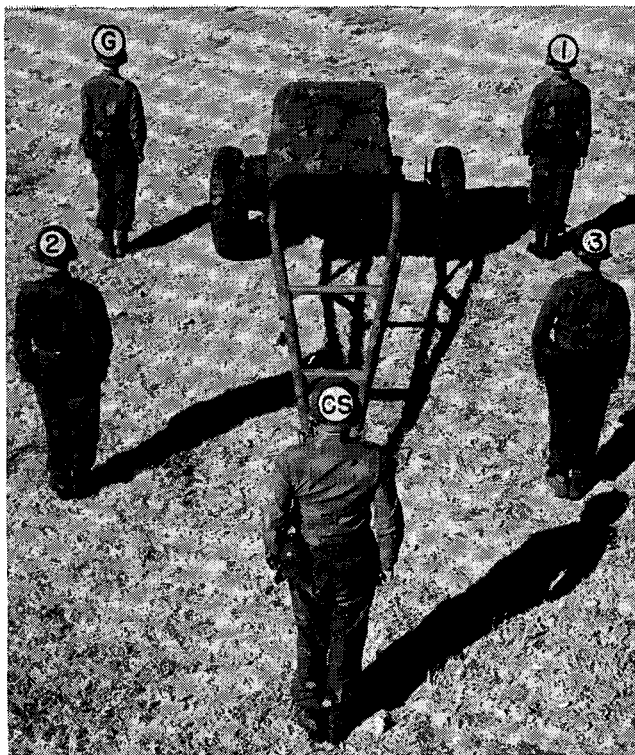


Figure 4. Posts of section, launcher uncoupled, not prepared for action.

tion to the post of No. 1. All other members of the section stand fast.

b. At 1. SECTION, CHANGE POSTS, 2. MARCH, all members of the section except the driver (or leftmost member of the section) take two left steps. The driver moves at double time in rear of the section to the post of the gunner.

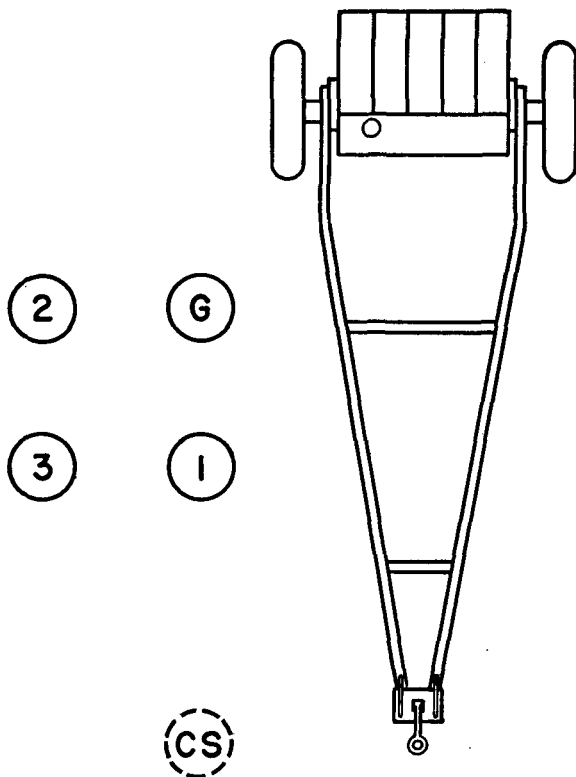


Figure 5. Posts of section, launcher prepared for action.

11. To Mount

The commands are 1. PREPARE TO MOUNT, 2. MOUNT, or MOUNT. If any members of the section are to remain dismounted, their designations are announced with the caution "stand fast" given between the preparatory command and the command of execution. For example: 1. PREPARE TO MOUNT, "driver stand fast" 2. MOUNT.

a. 1. PREPARE TO MOUNT, 2. MOUNT. At the preparatory command, the section moves at double time to positions shown in figure 6. At the command of execution, the gunner and rocketeers mount in order and take seats as in figure 7. They are assisted in mounting by the man behind or in front or by the chief of section and driver to insure promptness and prevent injuries. Before mounting, the chief of section and the driver verify that the launcher is properly coupled, that personnel and equipment are aboard, and that the tail gate and safety straps are secure.

b. MOUNT. At the command MOUNT, the section executes without pausing all that is prescribed for the commands 1. PREPARE TO MOUNT, 2. MOUNT.

12. To Dismount

The commands are 1. PREPARE TO DISMOUNT, 2. DISMOUNT, or DISMOUNT.

a. 1. PREPARE TO DISMOUNT, 2. DISMOUNT. Execution is as follows: At the preparatory command, members of the section assume positions from which they can dismount promptly; at the command of execution, they jump to the ground and at double time take posts as shown in figure 3.

b. DISMOUNT. At the command DISMOUNT, the section executes without pausing all that is prescribed for the command 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

13. To Fall Out

a. *At Drill.* When it is desired to give the personnel a rest from drill or to relieve them temporarily from a *formation* or *post*, the command FALL OUT is given. The command may be given



Figure 6. Section prepared to mount.

at any time, and infers that the section is to remain in the drill area.

b. When Firing. When firing has been suspended temporarily, but it is desired to have the section remain in the vicinity of the launcher, the command **FALL OUT** is given. Men stand clear of the launcher to insure that settings and laying remain undisturbed. During these periods the chief of section may direct his men to improve the position, to replenish ammunition, or to do other necessary work.

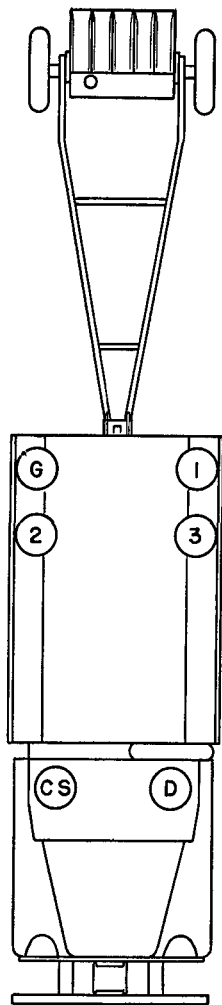


Figure 7. Section mounted.

CHAPTER 4

PREPARING THE LAUNCHER FOR FIRING AND TRAVELING

Section I. PREPARATIONS FOR FIRING

14. To Uncouple

a. The command is UNCOUPLE. At the command, members of the section take positions as shown in figure 8.

b. Individual duties in the execution of the command UNCOUPLE are as shown in table I.



Figure 8. Section uncoupling (coupling) the launcher.

Table I. Duties in Uncoupling

Se- quence	Chief of section	Gunner	No. 1	No. 2	No. 3	Driver
1	Commands, UN- COUPLE. Super- vises operation.	Take positions forward of trail lifting handles on the left and right of trail respectively.		Takes position at left trail lifting handle. Un- latches pintle.	Takes position at right trail lifting handle. Removes blackout light cable plug from receptacle on prime mover.	
2	When lunette is free from pintle, signals driver to move prime mover for- ward about 10 feet.		Lift on trail to detach lunette from pintle and lower trail to ground.			Drives vehicle for- ward as directed by chief of sec- tion.
3				Latches pintle.....	If prepare for action is not to be accomplished, wraps end of blackout light cable about right of trail so that it does not dangle freely or touch the ground.	

15. Direction

a. Action Front. If the command ACTION FRONT is given, the chief of section engages the left handbrake after the launcher is uncoupled. The gunner with Nos. 1, 2, and 3 then turns the launcher 180° in a clockwise direction and lowers the trail to the ground. Then the chief of section releases the handbrake.

b. Action Right (Left). The command is ACTION RIGHT (LEFT). The movement is executed as in ACTION FRONT, except that after the launcher is uncoupled, the trail is turned until the launcher points in the appropriate direction.

16. Movement of Launcher by Hand

The commands are 1. LAUNCHER(S) FORWARD (BACKWARD), 2. MARCH. At the command LAUNCHER(S) FORWARD (BACKWARD) the trail is lifted by the chief of section and Nos. 2 and 3. The gunner and No. 1 operate the left and right handbrakes as necessary and push on the tires to assist in the movement (fig. 9).

17. To Prepare for Action

The launcher being in position uncoupled, the command is PREPARE FOR ACTION. If PREPARE FOR ACTION has not been ordered by the platoon commander before the launcher is established in the firing position, the command is habitually given by the chief of section as soon as the launcher has been uncoupled. When the section has attained a high degree of proficiency, the command UNCOUPLE may be omitted. In this case, at PREPARE FOR ACTION the section will per-



Figure 9, Moving the launcher to the rear.

Table II. Individual Duties in Prepare for Action

Se- quence	Chief of section	Gunner	No. 1	No. 2	No. 3	Driver
1	Commands PRE- PARE FOR ACTION. Su- pervises work of all members of the section throughout all se- quences. Checks danger zone in front and in rear of launcher to in- sure that zone is clear of equip- ment and inflam- mable material (TM 9-392A). Directs removal, if necessary.	Gunner and No. 1 remove overall cover; spread it on ground to right of launcher.	Disengages travel- ing lock. Re- moves rocket re- taining pins and places them with accessories. Visually in- spects tubes for presence of for- eign matter.	Rotates drawbar and lunette to firing position.	Loosens straps on right side of trail. Removes blackout light system, coils it, and places it on overall cover.	Moves vehicle away from po- sition as direct- ed by chief of section.
2		Opens control box, removes telescope, adapter, and mount as a unit (and instrument light if needed) and installs them.	When launcher is positioned, digs trail spade hole, seating spade in the hole (par. 30).	Shift trail to facilitate positioning the launcher in the proper direction in center of traverse.		
3		Assisted by Nos. 2 and 3 on the trail, positions launcher for direction.				
4		Disengages elevat- ing lock (fig. 10), releases the elevat- ing hand wheel brake, and ele-		Removes trail stake from left side of trail; places trail stake in stake	Removes staff from case and bare brush from control box. As- sembles them	

5	Verifies that launcher is prepared for action and reports to platoon commander, "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.	vates launcher 5 to 10 degrees (90 to 480 mils). Re-moves firing switch safety plug from control box and attaches it to outside of box with chain and chain clip but does not insert in safety plug socket. Re-moves lanyard from control box, and fully uncoils it to firing position.	Position and secure blast deflector beneath launcher if so directed.	ring and drives the stake into the ground. Ob-tains wheel stakes from accessories and drives stakes in the ground as close as possible to each tire (TM 9-392A).	and places them with staff cover on overall cover.
					Takes aiming posts from case and assembles them (and lighting devices if needed). Sets them out if so directed, otherwise lays them clear of launcher. Places cover and straps on overall cover.

form the duties prescribed in table I and without hesitation continue with the duties for **PREPARE FOR ACTION** as listed in table II. After completion of designated duties, personnel take posts as shown in figure 5. If **PREPARE FOR ACTION** is not desired, the caution "do not prepare for action" must be given.

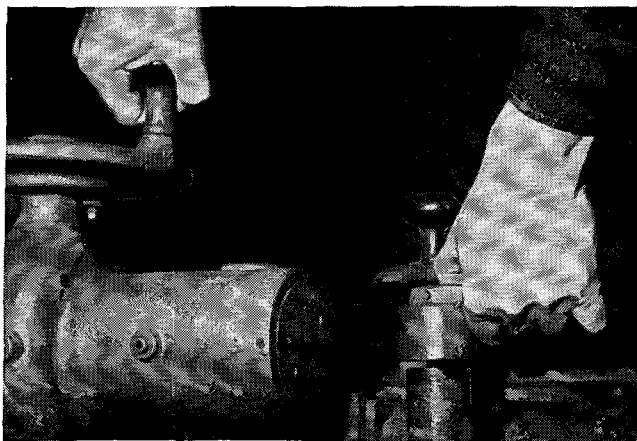


Figure 10. Disengaging elevating lock.

Section II. PREPARATIONS FOR TRAVELING

18. To Prepare for Travel (March Order)

a. To prepare to resume travel, the launcher being uncoupled and prepared for action, the command is **MARCH ORDER**. After completion of duties as designated in table III, personnel take posts as in figure 3.

b. Exceptions modifying march order duties are:

- (1) If firing is to be resumed shortly in another position to which the launcher must be towed



Figure 11. Alining aiming posts.

Table III. Duties in March Order

Se- quence	Chief of section	Gunner	No. 1	No. 2	No. 3	Driver
1	Commands MARCH ORDER. Supervises work of all members of the section throughout all sequences.	Insures that firing switch safety plug has been removed and places in control box. Removes sight, adapter, and mount as a unit (and instrument light if used) and returns them to control box. Detaches lanyard and returns it to control box.	Remove and stow blast deflector if used.		Retrieves and disassembles aiming posts; returns them to case and returns lighting device if used, to control box.	Drives prime mover to launcher position and parks where it is convenient for loading and equipment and coupling.
2	Checks ammunition to see that rounds and fuzes prepared for firing but not fired are properly readied for replacing in containers.	Traverses to assist No. 1 engage traveling lock. Sets traversing hand/wheel brake.	Inserts rocket retaining pins. Fills trail spade hole.	Removes trail stake and fastens on trail. Removes wheel stakes and loads on primemover.	Disassembles bore brush and staff. Returns staff to case and bore brush to control box.	
3		Operates elevating mechanism until ele-		Swings lunette to traveling position.	Fastens aiming posts and rammer	

		vating lock can be engaged. Locks elevating lock. Sets elevating handwheel brakes. Checks control box for completeness. Closes and latches box.	tion.	staff in position on trail. Installs blackout light system.
4	Verifies that all operations have been accomplished and reports to platoon commander, "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.	Gunner and No. 1 replace overall cover then join No. 2, No. 3, and Driver in returning any prepared ammunition to containers. Load and stow ammunition and equipment in prime mover.		
5		<p>Insure that parking brakes are released.</p> <p>Couple launcher to prime mover.</p>		

by its prime mover, only such of the operations incident to march order are performed as are necessary for the movement of the launcher and for the care and security of the equipment.

- (2) If the command **MARCH ORDER** is given after the launcher is coupled, the operations pertaining to march order are completed.
- (3) If coupling is not desired, a warning is included in the command as follows: **MARCH ORDER** "do not couple." In this case only sequences 1 through 4, table III, are performed.

19. To Couple

The command is **COUPLE**. This command is given if the launcher is uncoupled and not prepared for action. The section takes stations as for uncoupling and performs the duties for uncoupling (table I) in reverse.

CHAPTER 5

DUTIES IN FIRING

Section I. INDIRECT LAYING

20. Duties of Individuals

The instructions in paragraph 7 on the conduct of section drill apply equally to section drill in duties in firing. For duties of the battery executive and the platoon commander see FM 6-140. In general, the duties of individuals in the section in firing are as follows:

a. The chief of section supervises and commands his section and is responsible that all duties of the section are performed properly, all commands executed, and all safety precautions observed.

b. The gunner loads the launcher, sets the announced deflection and quadrant elevation, centers the cross-level and longitudinal-level bubbles, lays for direction and elevation, fires the launcher, and refers the launcher.

c. No. 1 prepares ammunition, sets fuzes, and assists the gunner in loading.

d. Nos. 2 and 3 assist No. 1 prepare ammunition and assist the gunner in loading.

e. The driver, after his vehicle is unloaded, is normally directed to the truck part designated by the battery commander, where he remains with his vehicle and performs maintenance operations unless otherwise directed.

21. Chief of Section

a. *List of Duties.*

- (1) Assisted by the gunner, lays the launcher for elevation when the gunner's quadrant is used.
- (2) Measures the site to the mask.
- (3) Measures the elevation.
- (4) Indicates to the gunner the aiming point.
- (5) Follows fire commands.
- (6) Checks electrical contacts and verifies the proper seating of rounds during loading.
- (7) Verifies the laying of the launcher and removes the sighting equipment as a unit before firing.
- (8) Indicates when the launcher is ready to fire.
- (9) Gives the command to fire.
- (10) Reports mistakes and other unusual incidents of fire to the platoon commander.
- (11) Conducts prearranged fires.
- (12) Records basic data.
- (13) Observes and checks frequently the functioning of the materiel.
- (14) Assigns duties when firing with reduced personnel.
- (15) Verifies the adjustment of the sighting and fire control equipment.
- (16) Designates the location of the section ammunition.
- (17) Checks, before it is placed in containers, all ammunition not fired that has been prepared for firing.

b. Detailed Description of Duties.

(1) *To lay for elevation when the gunner's quadrant is used.*

(a) The command **QUADRANT (SO MUCH)** indicates that the gunner's quadrant is to be used.

(b) An elevation of quadrant 361.8 for example, is set on the gunner's quadrant (fig. 12) as follows: The upper edge of the index plate is set opposite the 360 mark of the graduated frame, and the micrometer on the index arm is turned to read 1.8. Care must be taken to use the same side of the quadrant in setting both the index plate and the micrometer knob.

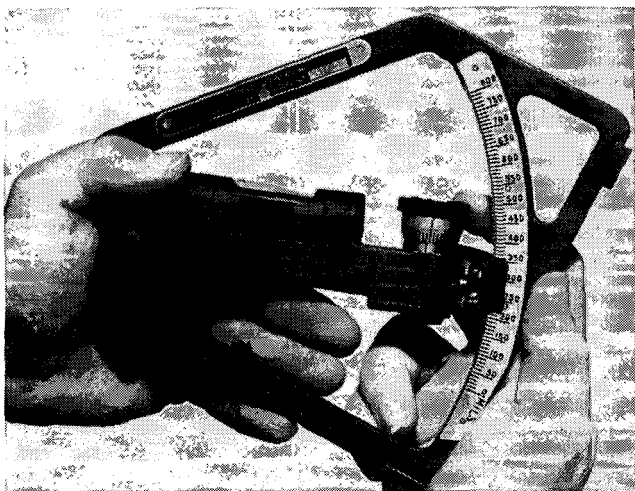


Figure 12. Setting the gunner's quadrant.

- (c) The announced elevation having been set on the gunner's quadrant, and the launcher loaded, the gunner's quadrant is set on the leveling surface atop the cluster (par. 34). The words *line of fire* must be at the bottom of the quadrant and the arrow pointing in the direction of fire. The chief of section must be sure to use the arrow which appears on the same side of the quadrant as the scale that he is using. He stands squarely opposite the side of the quadrant and holds it firmly on the leveling surface, parallel to the axes of the tubes. *It is important that he take the same position and hold the quadrant in the same manner for each subsequent setting.*
- (d) The chief of section then directs the gunner to elevate or depress the launcher until the bubble is centered, being careful that the last motion is in the direction in which it is more difficult to turn the hand-wheel. The chief of section cautions the gunner when the bubble is approaching the center, in order that the final centering may be performed accurately.
- (e) Normally, special and calibration corrections will be added algebraically at the fire direction center and are included in the command NO. (SO-AND-SO), QUADRANT (SO MUCH).
- (2) *To measure site to the mask.*
- (a) The command is MEASURE THE SITE TO THE MASK. The chief of

section has the gunner center the cross-level bubble. Then, sighting along the lowest element of the lowest center tube, he directs the gunner to traverse and elevate the cluster until the line of sight just clears the crest at its highest point in the probable field of fire. He then directs the gunner to measure the elevation. The chief of section verifies the elevation set on the elevation scale and micrometer and reports to platoon commander, "No. (so-and-so), site to mask, (so much)."

- (b) If use of the elevation scale on the telescope mount is impractical, the chief of section may measure the site to the mask by using the gunner's quadrant on the leveling surface on the cluster.
 - (c) When the platoon commander announces the minimum elevation the chief of section records it in a notebook and directs the gunner to chalk the minimum elevation on a convenient place on the launcher.
- (3) *To measure the elevation.* The command is **MEASURE THE QUADRANT ELEVATION (QUADRANT)**. The launcher having been laid, the chief of section causes the gunner to center the cross-level bubble and the longitudinal-level bubble. The chief of section then reads the elevation set on the elevation scales and reports "No. (so-and-so), quadrant elevation, (so much)." If the command was **MEASURE THE QUADRANT**, the chief of section

measures the quadrant with the gunner's quadrant and reports "No. (so-and-so), quadrant (so much)."

- (4) *To indicate to the gunner the aiming point.*

When an aiming point has been designated by the platoon commander (FM 6-140), the chief of section will make sure that he has properly identified the point designated. He will then indicate it to the gunner. If there is any possibility of misunderstanding, the chief of section will turn the telescope until the horizontal and vertical hairs are on the point designated.

- (5) *To follow fire commands.* The chief of section will follow fire commands. He will repeat the commands as required.

- (6) *To check the electrical contacts and verify the proper seating of the rounds.* Before directing that the launcher be loaded, the chief of section inspects each tube to insure that the tubes are clear and clean and that the firing circuits are clean and operable. Each firing circuit is checked with the circuit tester (TM 9-392A). *After checking the circuits the chief of section removes the firing switch safety plug from its control box socket.* He checks to determine that the firing circuit is broken and he then directs the gunner to load the launcher. As the gunner loads the launcher the chief of section takes position at the rear of the cluster and inspects each round as it is being seated. He verifies that the safety shorting strip has been removed, that the spring con-

tact (hot) at the top of the tubes and the ground contact at the bottom of the tubes are in contact with the round, and that the sealing disk is in place on the back of the round. If deficiencies are found they will be corrected or the round unloaded and replaced with another round.

- (7) *To verify the laying of the launcher and remove the sighting equipment before firing.* Before firing, the chief of section must habitually check the laying for direction and elevation and then remove the sighting equipment (as a unit) from the launcher sight mount. He places the sighting equipment in the control box and closes and latches the control box cover.
- (8) *To indicate when the launcher is ready to fire.* When the platoon commander can see arm signals of the chief of section, the chief of section will raise his right arm vertically upward as a signal that the launcher is ready to fire. He gives the signal as soon as the gunner calls "Ready." When arm signals cannot be seen, the chief of section reports orally to the platoon commander "No. (so-and-so) ready."
- (9) *To give the command to fire.* When the gunner can see arm signals made by the chief of section, the chief of section will give the command to fire by dropping his right arm sharply to his side (fig. 13). When his arm signals cannot be seen, he commands orally NO. (SO-AND-SO) FIRE. The chief of



Figure 13. Chief of section signaling gunner to fire launcher.

section will not give the signal or command to fire until all personnel are clear of the danger zone in front, rear, and sides of the launcher (TM 9-392A).

- (10) *To report mistakes and other unusual incidents of fire to the platoon commander.* If for any reason the launcher cannot be fired, the chief of section will report promptly that fact to the platoon commander, and the reasons therefor; for example, "No. (so-and-so) out, broken lanyard" or "Misfires in tubes 7, 8, and 10." Whenever it is discovered that the launcher has been fired with a mistake in laying, the chief of section will report that fact at once; for example, "No. (so-and-so) fired 40 mils right." Whenever the gunner reports that the aiming posts are out of alinement with the sight, the chief of section will report that fact and request permission to realine them if the misalinement is due to progressive shifting of the launcher caused by firing. Likewise, he promptly reports other unusual incidents that affect the service of the launcher.
- (11) *To conduct prearranged fires.* Whenever the execution of prearranged fires is ordered, the chief of section will conduct the fire of his section in conformity with the prescribed data.
- (12) *To record basic data.* The chief of section will record data of a semipermanent nature in a notebook. This includes such data as minimum elevations; aiming points used and their deflections; prearranged fires when

section data sheets are not furnished; safety limits in elevation and deflection; number of rounds fired, with the date and hour; and calibration and special corrections when appropriate.

(13) *To observe and check functioning of the materiel.* The chief of section closely observes the functioning of all parts of the materiel during firing. He promptly reports to the platoon commander any evidence of malfunctioning (TM 9-392A).

(14) *To assign duties when firing with reduced personnel.* Whenever the personnel of the section serving the launcher is temporarily reduced in numbers below that indicated in this manual, the chief of section makes such redistribution of duties as will best facilitate the service of the launcher. Under-strength units, loss of cadremen, casualties, and various details will necessitate sections operating with a reduced number of personnel to the extent that it is almost normal for rocketeers to double up on duties. When around-the-clock firing is to be rendered, rocketeers must split up and work in shifts so that provision can be made for relief. Two sets of duty combinations are—

(a) *Section of four men.* Duties which may be combined are—

Chief of section (no other duty)

Gunner (no other duty)

No. 1 and No. 2

No. 3 and Driver.

(b) *Section of three men.*

Chief of section and gunner

No. 1 and No. 2

No. 3 and Driver.

- (15) *To verify the adjustment of the sighting and fire control equipment.* See chapter 7 and TM 9-392A for detailed instructions on testing and adjusting sighting and fire control equipment.
- (16) *To designate the location of the section ammunition.* The location of ammunition will normally be determined by the policy of the battery commander. When circumstances make necessary a departure from normal locations, the platoon commander will inform each chief of section of the location of the ammunition or authorize each chief of section to select the location for his section (par. 70).
- (17) *To check, before it is placed in containers, all ammunition not fired that has been prepared for firing.* The chief of section checks, before it is placed in containers, all ammunition not fired that has been prepared for firing. He insures that safety shorting strips have been replaced, that the lot number on the ammunition corresponds to the lot number on the container, and that fuzes have been handled in accordance with prescribed safety precautions (par. 23). It is imperative that all ammunition be returned to its original condition and packaging and that this ammunition be marked so that it may be expended before other ammunition

is prepared for firing in order that stocks of opened packages may be kept to a minimum.

22. Gunner

a. List of Duties.

- (1) Loads the launcher.
- (2) Centers the bubbles on the telescope mount.
- (3) Sets or changes the deflection.
- (4) Lays the launcher for direction.
- (5) Sets the quadrant elevation.
- (6) Lays the launcher for quadrant elevation.
- (7) Sets a common deflection on a common aiming point after the launcher has been laid.
- (8) Refers the launcher.
- (9) Alines aiming posts.
- (10) Makes corrections for aiming post displacement.
- (11) Prepares the launcher for firing and fires the launcher.

b. Detailed Description of Duties.

- (1) *To load the launcher.* Before loading the launcher the gunner elevates the launcher to 90 to 100 mils elevation to facilitate loading. He then stands in front of the launcher, receives the rockets from the rocketeers (fig. 14), and loads them in the tubes (fig. 15). When partially loading the launcher, he loads in the order of firing sequence (TM 9-392A). To receive the rocket, he grasps the fuze end with his right hand and rests the motor end in his left arm. After inserting the motor end of the rocket in the front of the tube he slides the rocket

to its seated position against the stop at the rear of the cluster. *Rockets must not be rammed into the tubes against the stops as this will crush the flange and short the rocket.* Rockets should be pushed in slowly and firmly to seat against the stops.

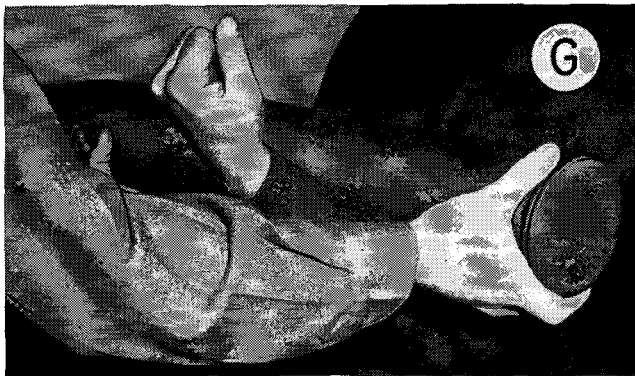


Figure 14. Gunner receiving rocket from a rocketeer.

- (2) *To center the bubbles on the telescope mount.* The gunner centers the level bubbles on the telescope mount as part of all operations that involve the use of the telescope or the telescope mount except as described for direct fire (par. 27). These bubbles are centered prior to using the telescope and the level of the mount bubbles is verified before firing.
- (3) *To set or change the deflection.* The gunner is taught that turning the azimuth micrometer knob in a clockwise direction *increases* the deflection set on the telescope

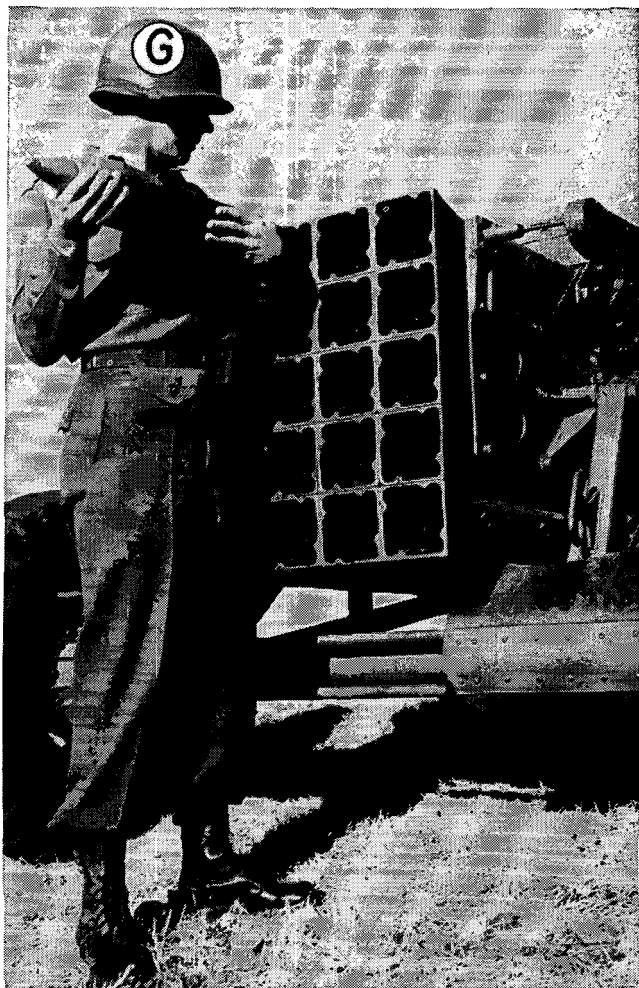


Figure 15. Gunner loading a rocket.

and results in moving the tubes to the *left* when the launcher is laid with the new deflection. Similarly, he is taught that turning the azimuth micrometer knob in a counterclockwise direction *decreases* the deflection and results in moving the tubes to the *right* when the launcher is laid. If for example the command is DEFLECTION 2850, the gunner turns the azimuth micrometer until the azimuth scale is set at 28 (2800) and the azimuth micrometer scale reads 50. He then levels the cross-level bubble and traverses to the aiming point as in (4) below. If a command requires a deflection change of several hundred mils the gunner sets the deflection by disengaging the worm gear with his left hand and with his right hand turns the rotating head of the sight to the even hundred mil reading on the azimuth scale. He releases the throwout lever and with his left hand turns off the remaining mils on the azimuth micrometer scale.

- (4) *To lay the launcher for direction.* The deflection having been set, the gunner brings the vertical hair of the telescope on the aiming point by traversing the launcher. To traverse the launcher the gunner releases the traversing handwheel brake, rotates the handwheel to position the launcher, and then sets the handwheel brake to prevent movement of the cluster during firing. If the amount of movement necessary is greater than can be obtained by traversing,

the trail must be shifted. To have the trail shifted the gunner commands or signals **CLUSTER RIGHT (LEFT)**. The rocketeers remove the wheel and trail stakes and shift the trail so that the cluster moves in the indicated direction. They stop when directed to stop by the gunner and then replace the stakes. The gunner then completes the laying by bringing the vertical hair of the telescope on the aiming point by traversing, being careful that the last motion is such as to cause the hair to approach the aiming point from the left. He verifies that the cross-level bubble is level, that the deflection is set, and that the vertical hair is still on the aiming point.

- (5) *To set a quadrant elevation.* The gunner is first taught to read quadrant elevations set and then to set announced quadrant elevations. The scale is read opposite the elevation scale index and the micrometer opposite the micrometer index. The quadrant elevation is set by turning the elevation knob *clockwise* to *increase* the elevation, and *counterclockwise* to *decrease* the elevation. The quadrant scale is graduated into 100-mil divisions and is numbered every 200 mils. The elevation micrometer scale on the elevation knob is graduated in 2-mil divisions and is numbered every 10 mils. It has two successive scales of 100 mils each. One complete turn of the elevation micrometer makes a 200 mil change in the elevation setting. The gunner grasps

the elevation knob in his right hand and turns it until the announced elevation is shown, making sure that the last motion is in the direction of increasing elevation. He must interpolate to set quadrant elevations ending in odd numbers. To set a command of QUADRANT ELEVATION 273, the gunner rotates the elevation knob in the appropriate direction until the space between 200 and 300 on the scale is opposite the index. He refines the setting by turning the elevation knob until 73 is opposite its index (fig. 16). The last motion should always be in the direction of increasing elevation.

Note. Interpolation between 72 and 74 is necessary in this case.

- (6) *To lay the launcher for quadrant elevation.* The quadrant or quadrant elevation having been set, the gunner levels the longitudinal-level bubble or the bubble on the gunner's quadrant by elevating or depressing the tube cluster with the elevating handwheel. The last motion of the cluster is in the direction in which it is most difficult to turn the handwheel. To elevate the cluster he releases the elevating handwheel brake, rotates the elevating handwheel to set the launcher at the desired elevation, and then sets the elevating handwheel brake to prevent movement of the cluster during firing.
- (7) *To set a common deflection on a common aiming point after the launcher has been*

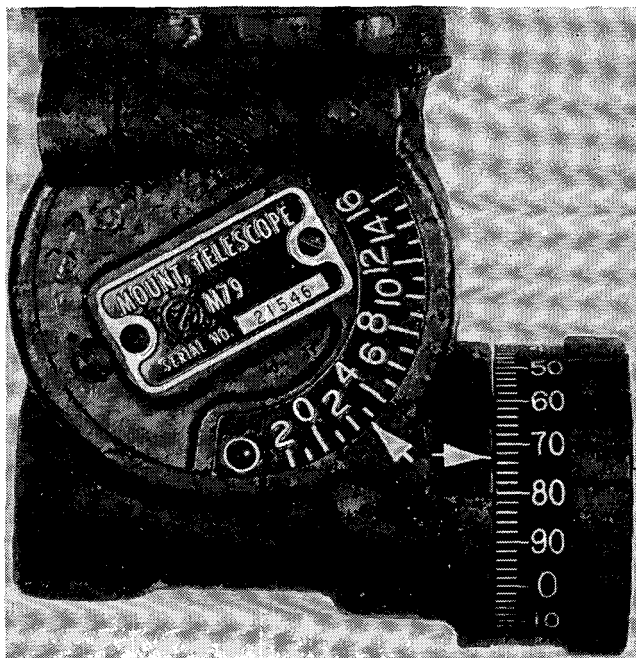


Figure 16. Quadrant elevation 273.

laid. The launcher having been laid, the platoon commander may command AIMING POINT, CHURCH STEEPLE, REFER. At this command without moving the cluster, the gunner opens the door (fig. 17), turns the sight to the aiming point designated, records, and reports the deflection to the platoon commander. The platoon commander then commands COMMON DEFLECTION 2800. At this command the gunner loosens the wing nut to release

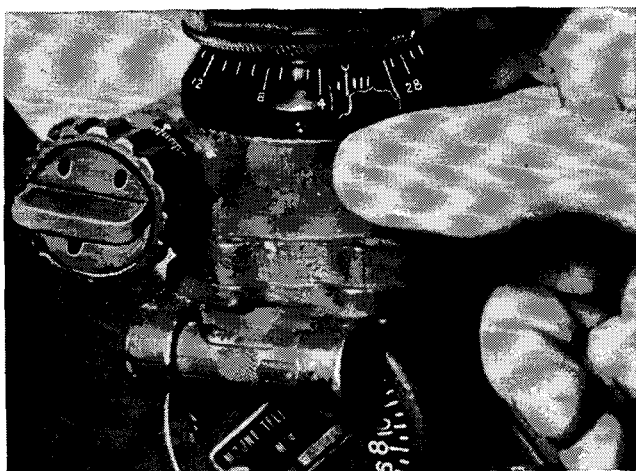


Figure 17. Opening the door.

the index ring (fig. 18). He slips the index ring until the index is opposite 2800 on the outer azimuth scale (fig. 19), closes the door, and tightens the wing nut. To bring the azimuth micrometer scale to zero, the azimuth micrometer slipping clamp is loosened (fig. 20), the azimuth micrometer scale slipped to zero (fig. 21), and the clamp is tightened. This done, the gunner must recheck to verify that the sight is set at 2800 exactly, that the cross-level bubble is level, and that the line of sight is still on the aiming point. The gunner then reports, "No. (so-and-so), deflection 2800."

- (8) *To refer the launcher.* To refer the launcher, the command is **AIMING POINT (SO-AND-SO), REFER.** Without dis-

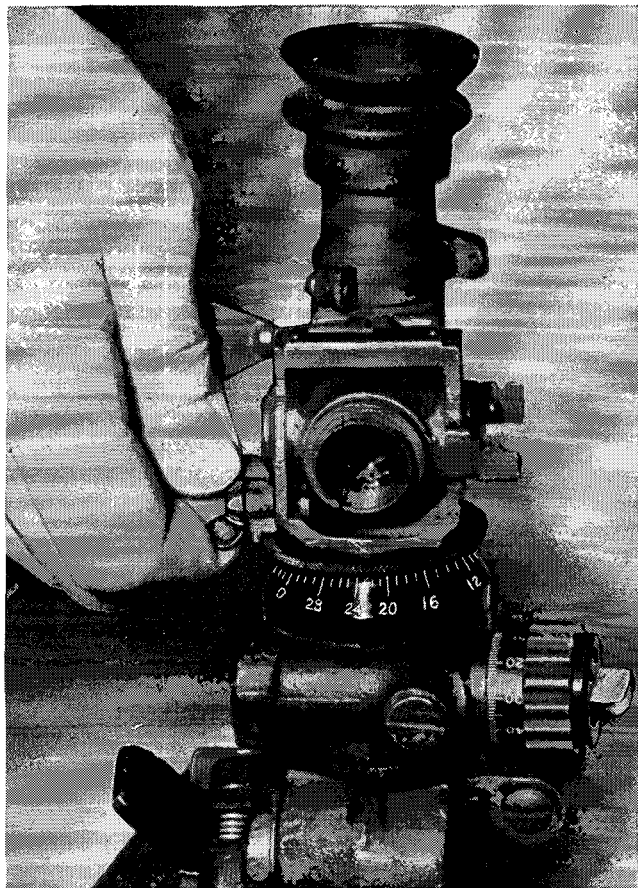


Figure 18. Loosening the wing nut to release the index ring.

turbing the position of the cluster, the gunner levels the bubbles and brings the vertical hair of the telescope on the designated aiming point (referring point). He then

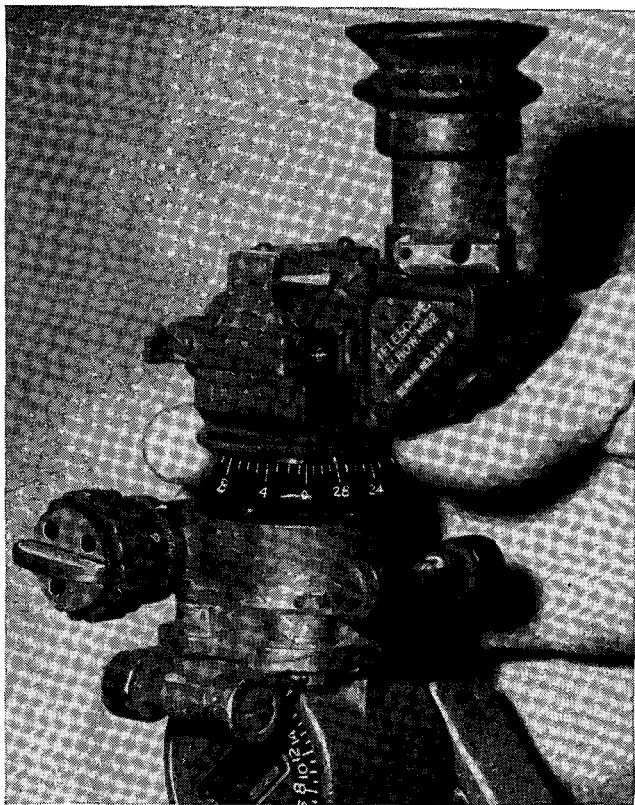


Figure 19. Slipping the index ring index to 2800.

checks the level bubbles and reads and announces the deflection set. Two referring points ordinarily are used, one for day and the other for night. A referring point should be at least 50 yards from the telescope. Normally, the aiming posts will be

used as referring points, particularly at night. The gunner records the deflection and referring point in current use on a convenient part of the launcher.

- (9) *To aline the aiming posts.* The launcher having been laid the platoon commander may command AIMING POINT, AIMING

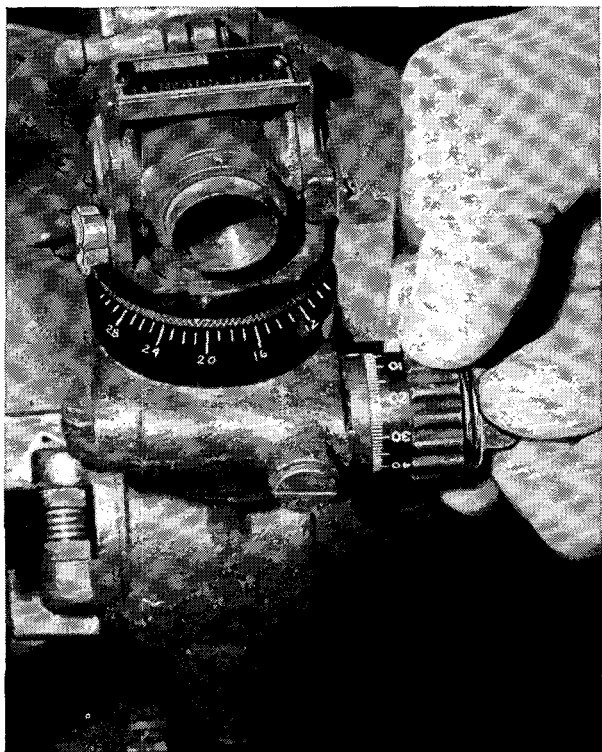


Figure 20. Loosening the azimuth micrometer slipping clamp.

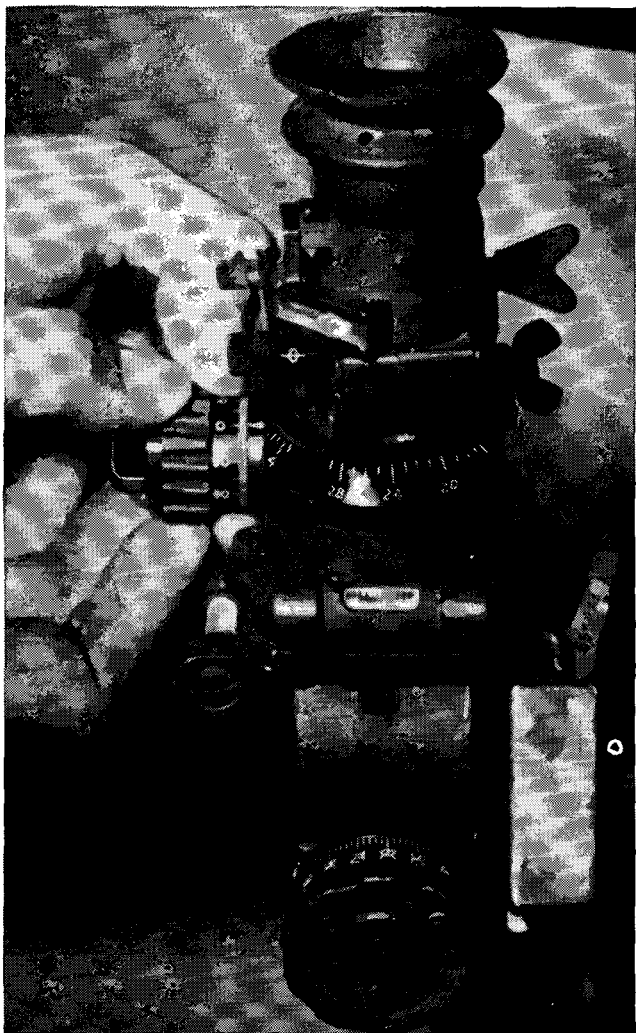


Figure 21. Slipping the azimuth micrometer scale to zero.

POSTS, DEFLECTION 2800, REFER.

At this command the gunner sets the sight at deflection 2800 and, with hand signals, directs No. 3 in the alinement of the posts (par. 29) with the vertical hair of the reticle (fig. 11). If, because of the nature of the terrain, the posts cannot be set out at deflection 2800, the gunner turns the azimuth micrometer knob until the outer azimuth scale is on another even hundred-mil graduation where the posts can be set out. He alines the posts at this new deflection. The chief of section reports the altered deflection to the platoon commander, "No. (so-and-so) aiming posts at (so many hundred), deflection 2800 in lake (or other reason)." The platoon commander will then command NO. (SO-AND-SO) DEFLECTION 2800. At this command the gunner loosens the wing nut, and slips the index ring to 2800. He tightens the wing nut and verifies the adjustment.

- (10) *To make corrections for aiming post displacement.* For details of correcting for aiming points displacement, see paragraph 29.
- (11) *To prepare the launcher for firing and to fire the launcher.* The gunner insures that the control box cover is closed and latched. He rotates the firing switch index pointer to engage the shaft and sets the pointer at the desired position (TM 9-392A). He attaches the lanyard to the firing switch lever (fig. 22), insuring that the lanyard has

been extended its full 50-foot length to the side. To fire the launcher from the left side, the lanyard is clipped to the upper hole in the firing switch lever and is placed in the left guide. To fire the launcher from the right side, the lanyard is clipped to the lower hole in the firing switch lever and is placed in the right guide. After he makes certain that all personnel are clear of the danger zone, he inserts the firing switch safety plug in its control box socket in the position that corresponds to the type of electrical power to be used (generator or battery). He stations himself at the end of the lanyard (fig. 13), calls "Ready," and at the command of the chief of section to fire, pulls the lanyard in rapid successive pulls until the ripple has been fired. To operate the firing switch generator fast enough to provide current for firing, the lanyard must be given quick pulls. Each pull of the lanyard must operate the firing switch lever to its stopping point to assure proper firing switch operation and proper indexing of the firing switch distributor. For speed in firing the gunner may use a rhythmic up and down waving motion of his arm. The necessary pull is exerted at the top and bottom of the motion while the lever is allowed to recover at the middle of the arc described by the waving motion. Each pull of the lanyard fires *one* rocket and positions the firing switch for firing the next rocket. In the event of misfires pro-

ceed as prescribed in paragraph 71. If no misfire occurred remove the firing switch safety plug from the control box socket.

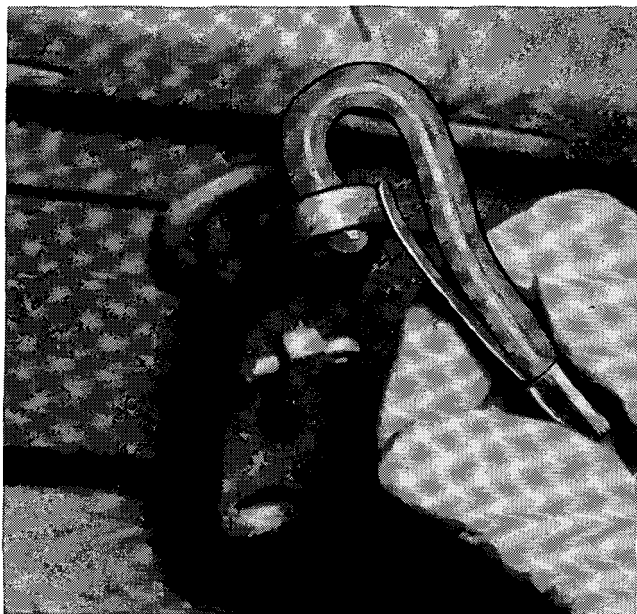


Figure 22. Attaching lanyard to firing switch lever.

23. No. 1

a. List of Duties.

- (1) Examines rockets.
- (2) Fuzes rockets.
- (3) Makes the prescribed setting of fuzes.
- (4) Passes ammunition to gunner.
- (5) Cleans and inspects the tubes.
- (6) Removes fuzes from rockets.

b. Detailed Description of Duties.

- (1) *To examine rockets.* No. 1, assisted by Nos. 2 and 3, removes the packing and inspects the rocket for serviceability (TM 9-1950). He examines the rocket to see that the plastic closing disk is in place and that the rocket is free of foreign matter, sand, mud, moisture, frost, snow, ice, or grease. If rockets are dirty or wet they should be wiped off with a clean, dry cloth. If the plastic closing disk is loose, it may be replaced and the rocket fired if it can be ascertained that no moisture or foreign matter has entered the motor. Should evidence be found of moisture corrosion which would adversely affect the igniter or propellant, the rocket should be disposed of as unserviceable.
- (2) *To fuze rockets.* With the rocket on its side, No. 1 loosens the setscrew in the adapter (when present) with a screwdriver or the end of the fuze wrench. Using the appropriate fuze wrench or any suitable wrench, he unscrews the nose plug and examines the fuze threads and cavity in the rocket head; examines for the presence of the supplementary charge; and if necessary removes the cardboard spacer. If the supplementary charge is required and none is present, No. 1 inserts the charge with the felt-pad end innermost and the lifting cloth tape loop outermost. If the charge is present and not required, No. 1 removes the charge. He then removes the fuze from its packing and examines the fuze threads to insure that they

are in good condition. Components with damaged threads are not used. He screws in the fuze by hand. If binding occurs No. 1 reinspects the fuze cavity and the threads of both the rocket head and the fuze, rejecting whichever is at fault. Next, he tightens the fuze securely to the rocket head using the appropriate fuze wrench (fig. 23). Fuze wrench M7A1 or M18 may be used for tightening the point-detonating fuze but only the special fuze wrench M18 issued with boxes of VT fuzes may be used to tighten VT fuzes. He uses only such force as can be applied by hand to the fuze wrench handle. If the fuze cannot be tightened to form a good seat between the shell and fuze, the component at fault is rejected. *Do not use a hammer or an extension handle on the fuze wrench; use only manual force.* Finally, No. 1 tightens the setscrew firmly in the adapter, if one is present.

- (3) *To set fuzes.* When using point detonating fuze, if the command is FUZE QUICK No. 1 verifies that the slot on the setting sleeve is alined with the letters S. Q. If the command is FUZE DELAY he turns the slot to aline with the word DELAY (fig. 24). He resets to S. Q. any unfired fuzes that have been set to DELAY. No. 1 turns the slot to the appropriate index mark by using the screwdriver end of the fuze wrench or a similar tool. In the dark this can be done by feeling the position of the slot.



Figure 23. Fuzing a rocket.

- (4) *To pass ammunition to the gunner.* The rocket is passed to the gunner (fig. 14) so that he is able to grasp the fuze end in his



Figure 24. Setting a fuze.

right hand and support the motor end in his left arm.

- (5) *To clean and inspect the tubes.* No. 1 will clean the tubes when directed to do so. He inspects the tubes after each ripple is fired and reports misfires. Checking the tubes after firing is done from a position to the side of the launcher rather than from the front or rear.
- (6) *To remove fuzes from rockets.* If for any reason a projectile that has been fuzed is not to be fired, the fuze is removed. The operation of inserting a fuze is reversed. Supplementary charges will be replaced, provided the projectile was issued with the charge. Booster cotter pins, if required, are replaced. Point detonating fuzes are reset to superquick ((3) above). All fuzes are returned to their original condition and packing and marked for priority use in order that opened packages will be kept to a minimum. The nose plugs are replaced in the fuze sockets of the rockets.

24. Nos. 2 and 3

a. List of Duties.

- (1) Remove ammunition from containers.
- (2) Assist No. 1 in preparing ammunition for firing.
- (3) Pass ammunition to gunner.
- (4) Sets out aiming posts (No. 3).

b. Detailed Description of Duties.

- (1) *To remove ammunition from containers.*
When directed to do so, Nos. 2 and 3 remove

ammunition from containers. Only the required number of rockets and fuzes should be opened because explosives, especially rocket propellants, are adversely affected by moisture and high temperature. As the rockets are unpacked they are arranged on a clean tarpaulin with the nose plugs facing in the direction which would result in the least damage should the propellant be accidentally ignited. Packing is not disposed of until after the rockets have been fired because unfired rockets must be restored to their original condition and packing (TM 9-392A).

- (2) *To assist No. 1 in preparation of ammunition for firing.* Nos. 2 and 3 assist No. 1 in fuzeing and inspecting rockets (fig. 23) and they remove the safety shorting strips from rockets before they are carried to the gunner for loading.
- (3) *To pass ammunition to the gunner.* Nos. 2 and 3 pass ammunition to the gunner as prescribed for No. 1 in paragraph 23.
- (4) *To set out aiming posts.* No. 3 sets out aiming posts as directed by the gunner (par. 29).

Section II. DIRECT FIRE

25. General

Direct fire is not considered a normal role for the multiple rocket launcher. Should the necessity to defend the position arise, however, sections must be trained in the method of delivering direct fire.

Training for direct laying is based on the same technique involved in indirect laying. Enemy targets taken under direct fire by the section are usually those capable of returning fire on the launcher section at point-blank range, therefore, the speed and accuracy required in indirect laying becomes even more important for direct fire missions. In static situations plans for position defense should be pre-arranged, making each section responsible for the defense of an assigned sector. The section will operate as an independent unit in the defense of its assigned sector. In addition to defending his own sector, the chief of section should be prepared to fire on targets in other sectors as well. The sectors of fire for the launcher should, if possible be cleared of all obstructions that might endanger battery personnel when the launchers are fired or that might hinder observation. Care should be taken that such clearance does not give away location of the position.

26. Range Card

When the section occupies a position for a period longer than that required to prepare the launcher and fire the mission, the chief of section should prepare a range card (fig. 25). As soon as possible after moving into the position, the chief of section measures or estimates the ranges to critical points in likely avenues of approach for enemy personnel and vehicles. He notes these ranges and their corresponding quadrant elevations on the card. If there are no prominent terrain features, stakes may be driven into the ground at critical points for reference. As time permits, the range card is improved by replacing estimated ranges with more accurate data obtained

by pacing, taping, vehicle speedometer reading, map measurement, or other survey.

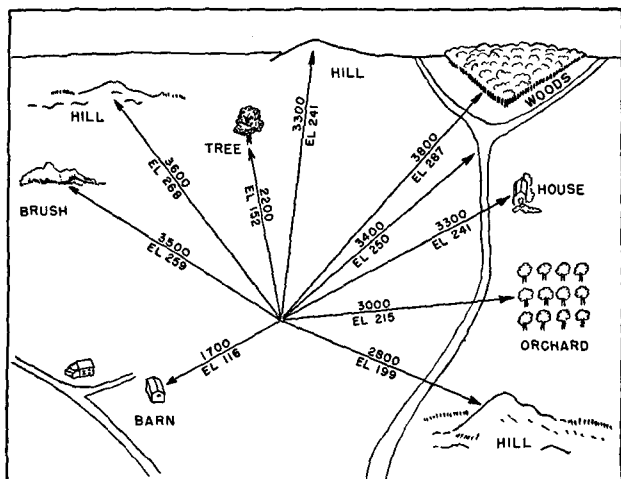


Figure 25. Range card.

27. Conduct of Fire

a. Prior Planning. Firing should be prearranged to include the number of rockets to be fired, the tubes to be loaded, the elevation at which the launchers will be laid, and if possible the direction of fire.

b. Targets for Direct Laying. Targets for direct laying usually consist of hostile vehicles, tanks, and personnel threatening the position. Enemy personnel, whether alone or accompanying tanks, will seldom present themselves as a clearly defined target. Normally, attacking troops, using all available cover, reveal themselves only fleetingly. Accordingly fire is conducted on the area containing the attackers

rather than upon the individuals. Tanks usually attack in groups and may be accompanied by infantry. Normally, first priority is given to attack of those targets within the assigned sector of the weapon and second to targets in other sectors.

c. Fuzes. Fuze quick is the most desirable fuze to use for close-in fires. It is effective and requires no fuze setting. VT fuzes are impractical for close-in fire and will seldom, if ever, be used for direct fire.

d. Commands. The command to open fire on direct fire targets comes initially from the platoon commander. He commands TARGET (SO-AND-SO), FIRE AT WILL, or simply FIRE AT WILL. The chief of section takes direct control of the fires of his section and gives the necessary commands to take the target under fire.

e. Duties. Direct fire duties are the same as those prescribed for indirect fire except that in the interest of speed the chief of section may perform some of the gunner's duties. Firing will be expedited if the chief of section lays the launcher for deflection and elevation.

f. Techniques. The nature of the target and the time available will dictate the technique to be employed in direct fire.

- (1) *Area targets.* Targets that have no specific point at which to aim may be laid on for direction by using the open sight on the sight mount or by sighting over the tubes. This method of laying for direction coupled with setting the quadrant elevation corresponding to the estimated range to the target area is the most expeditious means of delivering direct fire.

(2) *Point targets.* For targets that are clearly defined, the telescope should be used. It is necessary to zero the telescope so that its line of sight is alined with the axes of the tubes. If neither the azimuth micrometer scale nor the index ring has been slipped, the chief of section brings them to zero. If *only the index ring* has been slipped to place the launcher on a common deflection, the door is opened and zero of the inner azimuth scale is brought to the inner index and the zero of the azimuth micrometer scale is alined with its index. *If the index ring and the azimuth micrometer scale have both been slipped*, the sight may be referred to the original aiming point; the door is opened; the azimuth micrometer slipped to reset the original (par. 22b (7)) deflection on the sight; and then the azimuth micrometer and inner azimuth scale brought to zero. If a scribed line has been made on the azimuth micrometer knob (par. 42), the door may be opened, the inner azimuth scale turned to zero, and the scribed line on the azimuth micrometer knob alined with the index. For laying on a stationary target with the sight zeroed the chief of section lays the launcher with the vertical hairline exactly on the target. For a moving target, the chief of section estimates the lateral speed of the target and sets the appropriate lead on the azimuth micrometer scale before bringing the vertical hair on the target. When the

launcher is laid, the chief of section removes the sight, steps clear of the weapon, and signals the gunner to fire. Based on the observed effect, the chief of section makes appropriate changes in settings on the launcher to adjust the fires of the launcher where they are desired.

CHAPTER 6

TECHNIQUES AND SITUATIONS THAT REQUIRE SPECIAL ATTENTION

28. Precision in Laying

a. Sighting and laying instruments, and elevating and traversing mechanisms must be properly operated to reduce the effects of lost motion. For uniformity and accuracy and to eliminate lost motion, all motions in setting instruments and in laying should be in the direction prescribed in this manual. To insure accurate laying in indirect fire the chief of section is required to verify the laying after the gunner has laid the launcher and before the sight is removed from the launcher for firing.

b. The line of sight when setting and reading a scale or centering a bubble should be at a right angle to the scale or level vial to prevent parallax errors. Bubbles should be centered exactly.

c. For uniformity and accuracy in laying on aiming posts, the vertical hair in the reticle of the telescope should be aligned with the left edge of the aiming posts.

29. Aiming Points and Displacement Corrections

a. General. After the launcher has been laid initially for direction it is referred to the aiming posts and usually to one or more distant aiming points. An aiming point must have a sharply de-

fined point or vertical line clearly visible from the launcher so that the vertical hair of the telescope can be alined on exactly the same place each time the launcher is relaid.

b. Distant Aiming Point. A distant aiming point is one at sufficient distance so that normal displacements of the launcher in firing or traverse will not cause a horizontal angular change in direction (with the same settings on the azimuth scales) of more than one-half mil. The platoon commander usually designates the distant aiming point or points to be used.

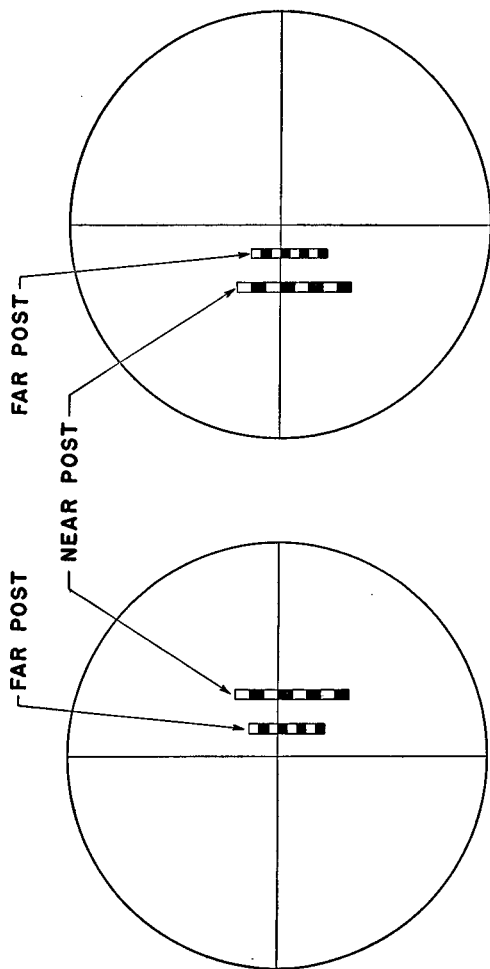
c. Aiming Posts.

- (1) Two aiming posts are used for each launcher. Each post is equipped with a light for use at night. The most desirable distance from the launcher to the far aiming post is 100 yards, considering accuracy of laying, visibility, and ability to control the aiming post lights. First, the far post is set up and alined. The near post is then set up and alined halfway between the far aiming post and the launcher. The vertical hair of the telescope must be on the left edge of the aiming posts for proper alinement. To insure equal spacing of aiming posts the same man should pace the distance to both posts.
- (2) For night use, the aiming post lights should be adjusted so that the far one will appear several feet above the near one. The two lights placed in this way will establish a vertical line for laying the launcher.

- (3) Since the telescope is mounted at considerable distance from the center of rotation of the launcher, large changes in deflection will cause misalignment of the aiming posts. Placing the aiming posts to the left front at a deflection of approximately 2800 when the launcher is in the center of traverse will keep this misalignment to a minimum and still allow for maximum visibility.

d. Correction for Displacement of Aiming Posts.

When the gunner notes that the vertical hair of the telescope is displaced from the line formed by the two aiming posts (or aiming post lights), he lays the launcher so that the far aiming post (light) appears exactly midway between the near aiming post (light) and the vertical hair (fig. 26). If the displacement is due to traversing the launcher, the gunner continues to lay as described above. If the displacement is due to progressive shifting of the launcher from shock of firing or other cause, the gunner will notify the chief of section, who, at the first lull in firing, will notify the platoon commander and request permission to realine the aiming posts. To realine, the launcher is laid with the far post midway between the near post and the vertical hair (fig. 26). The far aiming post is moved into alignment with the vertical hair of the telescope and then the near aiming post is alined. If terrain conditions make it impracticable to move one of the two aiming posts, the launcher is laid for direction and referred to the aiming post which cannot be moved. This deflection is recorded and reported to the platoon commander. The other post is alined and the



LEFT **DISPLACEMENT** **RIGHT** **DISPLACEMENT**

Figure 26. Gunner's sight picture of aiming posts in proper relationship when correcting for displacement.

azimuth micrometer scale is slipped to retain the same deflection that was used prior to realinement of the aiming posts.

30. Preparation of Position for Emplacement of Launcher

a. General. For detailed information on the preparation of the launcher position, see FM 5-15 and FM 6-140. The launcher should be emplaced on level ground to insure stability in firing and to reduce the probability of error due to cant.

b. Fire Precautions. To prevent fires, inflammable material is cleared from a fan-shaped zone ahead of and behind the launcher. The areas to be cleared of material capable of burning should extend 50 yards to the front and 50 yards to the rear of the launcher and should fan out from the launcher to widths of 50 yards.

c. Spade Pit. When the ground is sandy, loose, or very soft the spade plate should be bolted to the spade to provide more spade area and reduce the possibility of creeping. The spade plate can be bolted to the spade most easily before uncoupling the launcher from the prime mover (TM 9-392A).

d. Trench for Firing. If there is a possibility that direct fire must be delivered it will be advisable to provide a trench adjacent to the left side of the launcher to afford the chief of section some protection as he performs duties in connection with laying the launcher. The trench should be L-shaped (fig. 27) so that the chief of section can be partially protected from enemy fire while laying the launcher and have an earth barrier between his position and the launcher when it is fired.

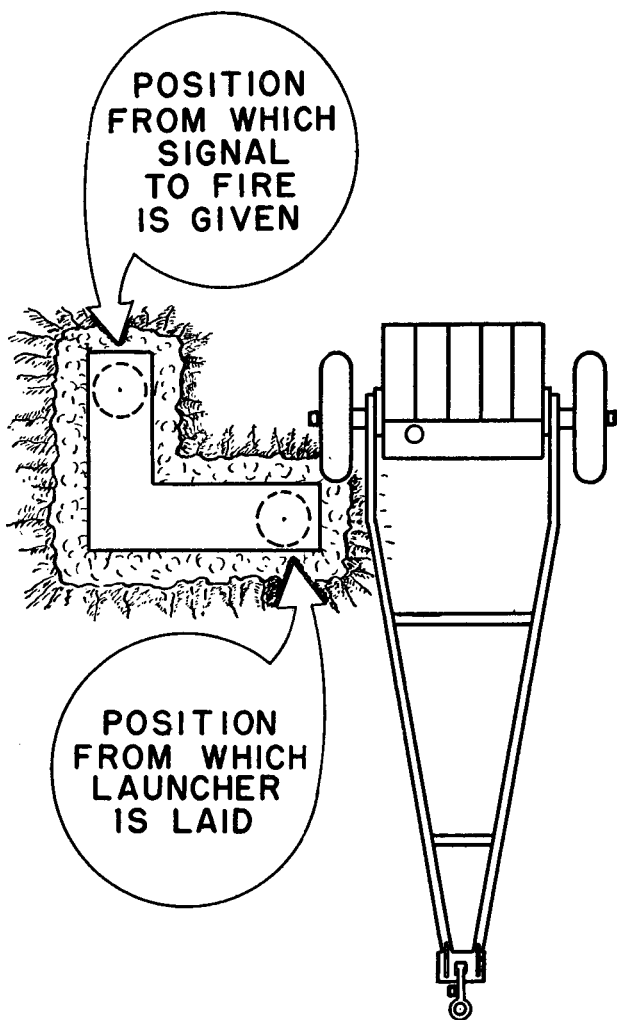


Figure 27. Trench for use in direct fire.

31. Blast Deflector

The blast deflector is a toboggan-shaped sheet of metal that deflects the blast of firing at the most concentrated area beneath the launcher. On dry ground where an excessive amount of dust will be churned up by firing, the deflector will serve to minimize the size and intensity of the dust cloud. It will not arrest the flash-back sufficiently to prevent fires in tinder-like foliage behind the launcher. The area behind the launcher must be cleared (par. 30b) even if the blast deflector is used. The deflector is secured to the launcher by means of five chain hooks (fig. 28) that wrap around the axle. The deflector must be removed prior to traveling.

32. Traveling With Launcher Loaded

Traveling with the launcher loaded requires extreme care. The added weight of the rockets places the launcher under stresses that might result in damage to it. Particular care must be exercised in traversing rough terrain. Speeds must be slow. The launcher should not be towed loaded unless the rocket retaining pins are in place and the elevating lock and the traveling lock are engaged. When preparing to fire after traveling with the launcher loaded, the rocket retaining pins must be removed and the seating of rockets rechecked.

33. Bore Sights

Bore sights are not currently issued for use with the launcher and must be improvised. Suitable bore sights are illustrated in figure 29. These bore sights were fashioned from 4½-inch (outside diameter) plastic tubing. The rear bore sight contains a small

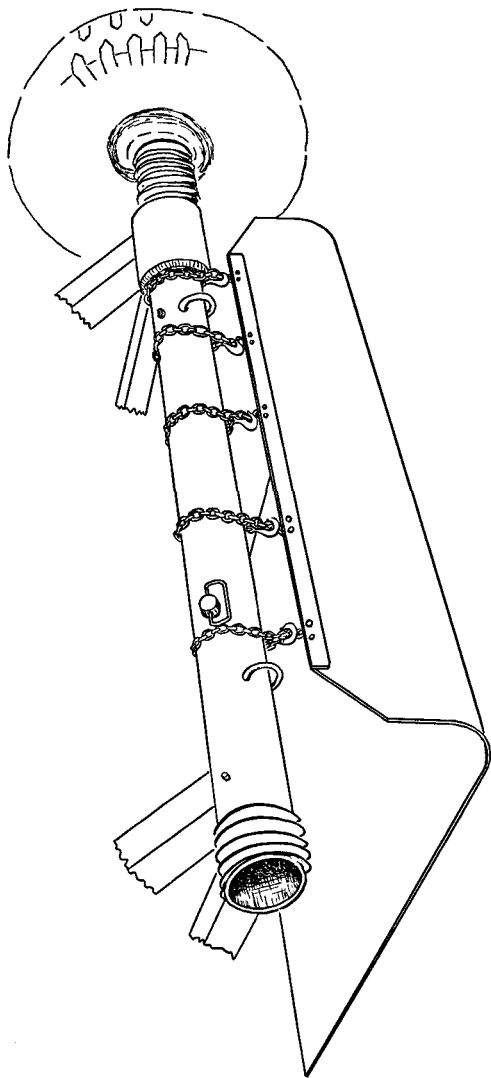


Figure 28. Blast deflector attached to launcher.

hole in its center and the front bore sight contains the cross hairs. When emplaced in the upper left tube the bore sights should fit snugly against the four lands.

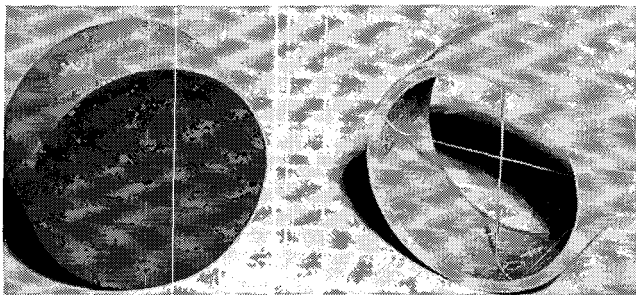


Figure 29. Improvised bore sights.

34. Models Having No Leveling Surface

Some launchers have no level surface for the gunner's quadrant atop the upper left tube. To facilitate using a gunner's quadrant on these launchers a piece of steel or plate glass having parallel faces may be placed on the bosses on the top surface of the top left tube and the gunner's quadrant held on the plate for measurements. Approximate cross leveling can be accomplished by placing the leveling plate across the bosses of two or more tubes and using the gunner's quadrant perpendicular to the axes of the tubes. When cross leveling the launcher, the cluster should be depressed to zero elevation.

35. Testing Target

A testing target may be improvised for use when no distant aiming point is visible for bore sighting. To improvise a testing target—

a. Carefully bore sight the launcher on a distant aiming point.

b. Place a flat piece of masonite, wallboard, or similar material covered with a sheet of weather resistant paper 50 yards in front of the launcher so that its face is perpendicular to the line of sight through the launcher. To render the testing target stable, it may be fastened to a stand similar to that shown in figure 30.

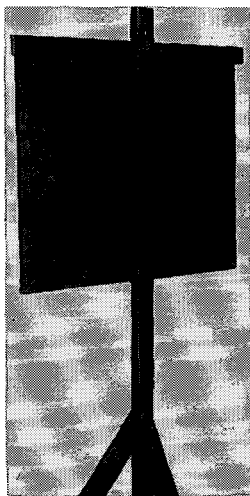


Figure 30. Rear view of a bore sighting target stand.

c. Without disturbing the relationship of the telescope to the cluster, mark on the paper the centers of the lines of sight through the telescope, the top left tube, and the lower left tube.

d. From the centers marked, construct aiming diagrams (fig. 31) such as are found on standard testing targets.

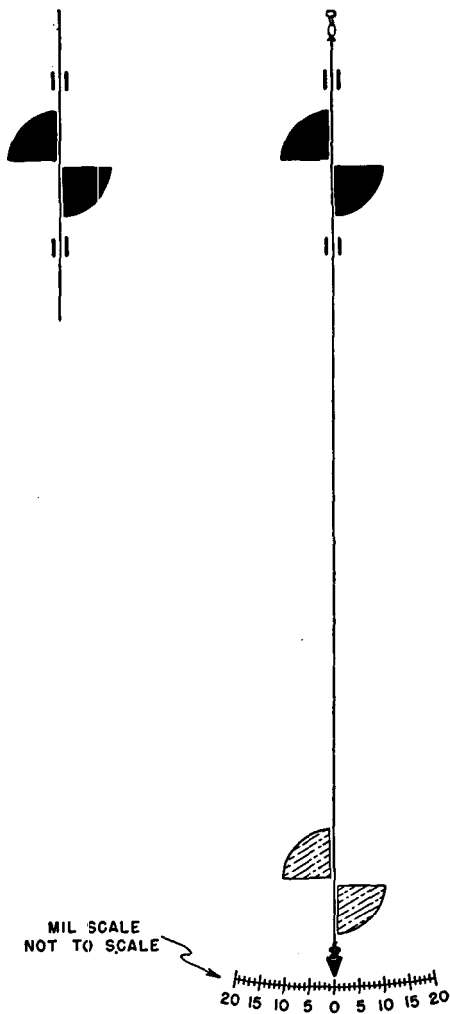


Figure 31. An improvised testing target.

e. For use in leveling or canting the test target (par. 45) either the two tube diagrams are alined or a mil scale inscribed at the bottom of the target may be used. A small nail at the top should mark the center from which the arc was drawn and will provide a hook from which to suspend the plumb line (fig. 31) when the target is canted (par. 45).

f. Vertical reference lines may be drawn vertically parallel to the centers of each of the diagrams (fig. 31). These lines may be used when the trunnions cannot be leveled to set the test target with the cant angle of the launcher. The target is rotated until the line of sight through the top left tube tracks between the reference lines when the launcher is elevated or depressed. Similarly the telescope should be adjusted so that the vertical hair of its reticle tracks between the appropriate reference lines when the tube is elevated or depressed.

g. To facilitate bore sighting in darkness bore a $\frac{1}{16}$ -inch hole through the mounted testing target at the center of each aiming diagram. A flashlight held against the target behind the appropriate hole provides an aiming point for use in blackout conditions. Fasten patches of felt padding on the back of the target covering the regions of each hole so that light from the flashlight will not escape. The flashlight must be lighted only after it is placed firmly in position. Care must be taken to prevent disturbing the position of the testing target.

36. Cease Firing

The command CEASE FIRING is normally given to the section by the chief of section, but in emergencies anyone present may give the command. At

this command, regardless of its source, firing ceases immediately. If the launcher is loaded, the chief of section reports that fact to the platoon commander. The platoon commander acknowledges this report by saying, "No. (so-and-so) loaded." If CEASE FIRING came from the fire direction center, firing is resumed at the announcement of the quadrant or quadrant elevation. If CEASE FIRING came from within the platoon the platoon commander will investigate the condition that caused the command to be given. When the condition has been corrected, firing is resumed by the platoon commander's announcement of the quadrant or quadrant elevation.

37. To Unload

a. Unless military necessity dictates otherwise, once a live rocket is loaded it should always be fired in preference to being unloaded. In the event of a misfire, the procedures in TM 9-392A must be followed. If a rocket must be unloaded, the command is UNLOAD.

b. Unloading should be under the direct supervision of an officer. As few personnel as possible should be in the immediate vicinity of the launcher during unloading.

c. The steps to be followed in unloading are—

- (1) Insure that the firing switch safety plug has been removed from the control box socket.
- (2) Depress the cluster to approximately 90 mils elevation.
- (3) With a mattock handle the gunner, standing to the flank pushes forward on the base of the rocket (fig. 32) until a rocketeer,

standing to the flank, can grasp the rocket as it emerges from the launcher.

- (4) Misfire rockets (par. 71) are kept separate from other rockets as they must receive special handling (TM 9-392A). Rockets that are merely unloaded (not misfires) are re-packed for future use.



Figure 32. Unloading.

38. Care of Ammunition

a. To insure uniform results in firing, to prolong the life of the tubes, and to avoid accidents, care must be exercised in the storage and handling of rockets at the battery. Provisions of TM 9-392A, TM 9-

1900, and TM 9-1950 applicable to field service should be followed carefully. In the field, conditions existing at each position will determine the amount of time, labor, and materials required to store and preserve the rockets adequately. If the position is to be occupied for only a few hours, a tarpaulin spread on the ground may be sufficient; for longer periods of time more adequate facilities should be provided.

b. Rockets must be protected from damage. When rockets are received, they should be sorted into lots and placed in the best available storage. The temperature of rockets should be kept as uniform as possible and should never exceed 120° F. Ammunition data cards should be kept until all rockets for that lot are expended. Rockets should be left in containers until their early use is expected. Protection should be provided against moisture, dirt, direct rays of sun, and as far as practicable, hostile fire and bombing. Protection against weather, dirt, and sun may be obtained by the use of tarpaulins below and above the ammunition, and suitable dunnage between the layers. Protection against hostile fire may be obtained by the use of small dispersed stacks, trenches, or dugouts. Each stack should contain not more than 75 rockets. Stacks should be at least 10 yards apart. The rockets should all point in one direction, preferably nose down, or toward a barricade. If this cannot be done they should be stacked so that they point in the direction likely to cause the least damage in the event of accidental ignition of the propelling charge.

c. For further information on care of ammunition, see FM 6-140, TM 9-392A, TM 9-1900, TM 9-1901, and TM 9-1950.

39. Section Data Board

When positions are occupied for more than a few hours, data boards may be used by each section for recording such items as deflections to aiming points, minimum elevations, data for barrages and counter-preparations, and other data that may be needed quickly.

CHAPTER 7

BORE SIGHTING AND BASIC PERIODIC TESTS

Section I. GENERAL

40. Purpose and Scope

The purpose of this chapter is to outline the procedures for bore sighting and making basic periodic tests of on-carriage fire control equipment. The procedures covered will include only those that may be accomplished at battery level.

41. Equipment

The following equipment is needed for performing bore sighting and periodic tests:

a. Bore Sights. Improvised front and rear bore sights (par. 33) are necessary for both bore sighting and testing.

b. Testing Targets. A testing target or suitable substitute is required for both bore sighting and testing. If a testing target has not been prepared (par. 35) a clearly defined aiming point 2,500 or more yards from the launcher may be used to accomplish approximately the same purpose as the testing target.

c. Plumb Line. Although not essential for bore sighting, it is necessary that a plumb line be used in the basic periodic tests in order to obtain maximum accuracy. The farther from the launcher that the plumb line is placed, the longer the line must be. For example, to be effective at 5 feet in front of the launcher tubes, the line must be approximately 25

feet long. To keep such a long plumb line taut it may be necessary to add weight to it. Wrenches or rocks may be used. The tendency of the weight to swing may be decreased by placing a bucket containing water or other liquid under the plumb line so that the plumb bob or other weight is partially immersed in the liquid. If a convenient means of suspension is not readily available, a pole may be employed. A plumb line strung from a building or tree as in figure 33 is more desirable and should be used if possible. Units in garrison may find it convenient to rig a plumb line on a building. The line may then be nailed in place so that it can be used permanently.

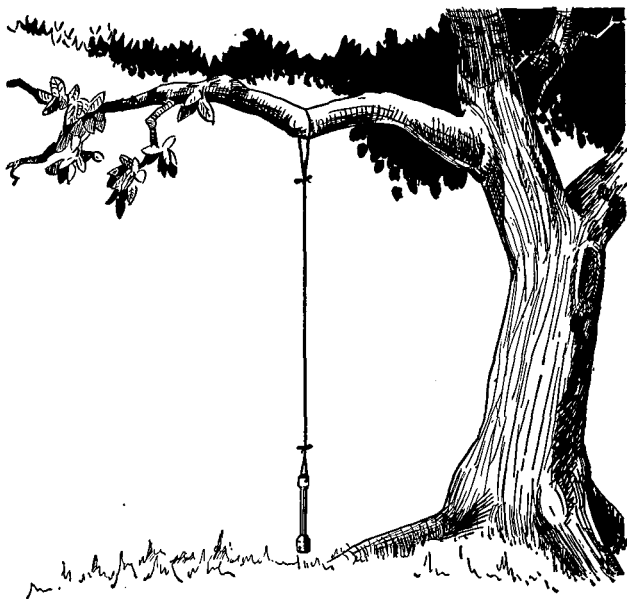


Figure 33. Plumb line suspended from tree.

d. Tools. The section equipment includes tools necessary for bore sighting and testing. Care must be taken in using the screw drivers and wrenches to insure that damage does not result through carelessness or the use of inappropriate tools.

42. Leveling

Prior to starting the tests, the launcher should be placed in its center of traverse. Although it is not absolutely necessary to level the trunnions for bore sighting, it is advisable to do so whenever possible. Accurate results can be obtained more readily if the trunnions are level, since a corresponding tilt does not have to be introduced in the panoramic telescope mount and in the testing target. The trunnions can be leveled by leveling the ground under the wheels or by blocking one axle or wheel. Approximate leveling may be measured by use of the gunner's quadrant and a leveling plate as explained in paragraph 34.

a. Plumb Line. The best method to check leveling is by means of the plumb line. The line is suspended approximately 5 feet directly in front of the axis of the top left tube. When the trunnions are level, the line of sight should track the plumb line as the tube is depressed and elevated throughout the limits of elevation and deviate from the line by no more than the thickness of the cross hair on the muzzle bore sight.

b. Gunner's Quadrant. In leveling operations using the gunner's quadrant, a quadrant that has been tested (par. 48) and found to be accurate is used.

c. Launcher Not Level. When it is impossible to level the trunnions the cross-level bubble cannot be used. If the cluster cannot be leveled the longi-

tudinal-level bubble cannot be used. To permit bore sighting when either of these conditions exist, lines should be scribed on certain sight mount components (fig. 34) after a basic periodic test (par. 48) when the sighting equipment is in correct adjustment. These scribed lines can be matched later, when leveling is impossible, to retain the same relationship between the axis of the cluster and moving parts of the on-carriage sighting equipment. After a basic periodic test with the tubes and sight in perfect alinement, use a knife blade or other sharp metal point to scribe the lines shown in figure 34. Care should be taken that the lines are scribed in the paint *only* and are not cut into the metal. Fill the scribed lines with white paint and wipe off the excess. If conditions prevent bore sighting with the cluster level, longitudinal compensation for an unlevel (elevated or depressed) tube may be made by matching the scribed lines at 2 (fig. 34). If the trunnions cannot be leveled, cross-level compensation may be made by matching the scribed lines at 3. The scribed line at 1, opposite the slipping azimuth micrometer index, represents deflection zero and is useful not only as an auxiliary index in bore sighting, but also to establish zero deflection for direct fire when the micrometer scale has been slipped.

Section II. BORE SIGHTING

43. General

a. Description. Bore sighting consists of making the optical axis of the telescope parallel to the line of sight through the centers of the tubes. It consists of those tests and adjustments that are performed by section personnel to insure accuracy in laying for

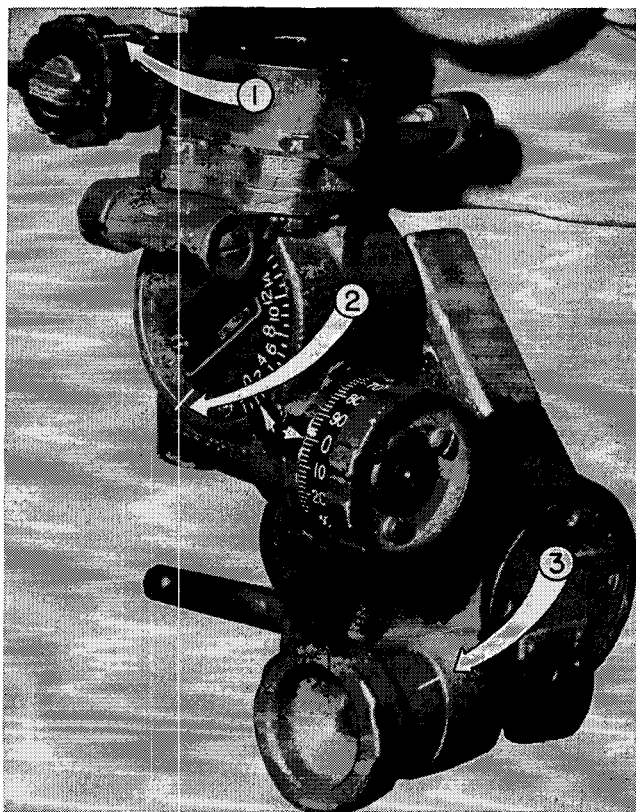


Figure 34. Scribed lines for positioning mount.

elevation and direction. The launcher should be placed near its center of traverse prior to bore sighting. All instruments and mounts must be positioned securely; there must be no free play. Bore sighting is conducted before firing and when necessary during lulls in firing.

b. Methods. Three methods of bore sighting the 4.5-inch multiple rocket launcher are—

- (1) Distant aiming point.
- (2) Testing target.
- (3) Aiming circle.

44. Distant Aiming Point Method

a. General. This method consists of alining the line of sight through the top left tube and the telescope on a common point at least 2500 yards from the launcher. Because the lines of sight converge on a single point, accurate cross leveling of the trunnions is unnecessary when bore sighting on a distant aiming point. Normally the cluster will not be level, so the scribed lines (fig. 34) will be matched.

b. Procedure. The steps to be followed are—

- (1) Insert the bore sights (par. 33).
- (2) Match the scribed lines (par. 42).
- (3) Bring the matching index lines on the elbow telescope into coincidence.
- (4) Bring the matching index lines between the elbow telescope and the telescope holder bracket into coincidence.
- (5) Sight through the upper left tube and traverse and elevate until the line of sight through the axis of the tube is on the aiming point.
- (6) Sight through the telescope and with the azimuth and elevation micrometer knobs place the cross hairs of the telescope on the aiming point.
- (7) If the azimuth micrometer scale does not read zero, loosen the azimuth micrometer slipping clamp (fig. 20), slip the azimuth

micrometer scale to zero (fig. 21), tighten the clamp, and verify the adjustment.

- (8) Note the other azimuth scale zero alinement with the index. If it is not in alinement, loosen the wing nut, slip the scale to zero, and tighten the wing nut. Open the door and verify that the inner azimuth scale is at zero.
- (9) If the elevation micrometer scale does not read zero, loosen the three clamping screws, slip the elevation micrometer scale to zero and retighten the screws. Verify the adjustment.
- (10) Note the elevation scale zero alinement with the index. If it is not in alinement, loosen the two elevation scale clamping screws, slip the elevation scale to zero, and tighten the screws.

45. Testing Target Method

a. General. This method consists of making the line of sight of the telescope parallel to the axes of the tubes, using the aiming diagrams of the testing target (par. 35) as aiming points. The testing target is placed about 50 yards in front of the launcher. Cant in the launcher trunnions must be duplicated in the testing target and if the cluster is not level longitudinally, the testing target must be tilted so that its face is perpendicular to the line of sight through the axes of the tubes.

b. Procedure. Steps to be followed:

- (1) Insert the bore sights.
- (2) Level the trunnions as exactly as possible. In no case should more than 20 mils cant be

present. If the trunnions cannot be leveled, match the scribed lines (fig. 34) ; if the trunnions can be leveled, level the cross-level bubble. If the trunnions are not level introduce the proper amount of corresponding cant in the testing target.

- (3) Using the gunner's quadrant, level the cluster. If the cluster cannot be leveled longitudinally, tilt the testing target as in *a* above.
- (4) Proceed as in (3) through (10) in paragraph 44*b*, except the telescope cross hairs and the bore sights are brought to their respective aiming diagrams on the testing target instead of on the distant aiming point.

46. Aiming Circle Method

a. General. The aiming circle method may be used when weather or terrain conditions prohibit the use of the distant aiming point method or the testing target method. The aiming circle method makes no provision for longitudinal adjustment. If, by the aiming circle method, misalignment is discovered and corrected it should be verified at the earliest opportunity, by bore sighting with a distant aiming point or the testing target. To facilitate bore sighting with the aiming circle certain preparatory steps must be performed. These operations, described in *b* below, should be performed after a basic periodic test (par. 47) when the sighting equipment is in correct adjustment.

b. Preliminary Operations.

- (1) The greatest care must be exercised in all phases of these operations. All final move-

ments of the instruments must be made so that the vertical hairs in the reticles approach the final position from left to right in order to eliminate the effects of lost motion in the gears.

- (2) *Parallax.* Parallax in the aiming circle and the telescope must be eliminated. This is done with the aiming circle after focusing by placing in front of the eyepiece lens a dark-colored cardboard or metal parallax shield of the same diameter as the eyepiece lens housing. The shield should have a vertically and horizontally leveled slot $\frac{1}{16}$ inch wide and $\frac{1}{4}$ inch long. It is placed in front of the eyepiece with the slot in the vertical position and may be held in place with a piece of adhesive tape around the edge of the focusing sleeve. To eliminate parallax in the telescope, a shield of the same diameter as the eyepiece lens housing and having an exactly centered hole $\frac{1}{16}$ inch in diameter is mounted in front of the eyepiece lens (fig. 35). A more permanent parallax shield may be constructed of brass or bronze shim stock. When constructed of metal a series of fingers approximately $\frac{3}{16}$ inch wide and $\frac{1}{4}$ inch long separated by $\frac{1}{4}$ -inch spaces should extend beyond the perimeter of the shield. These fingers should be bent along the circumference of the circle until they form an angle of 90° with the surface of the shield. They serve as a means of clipping the shield in place quickly and permit easy removal. Where the eyepiece has

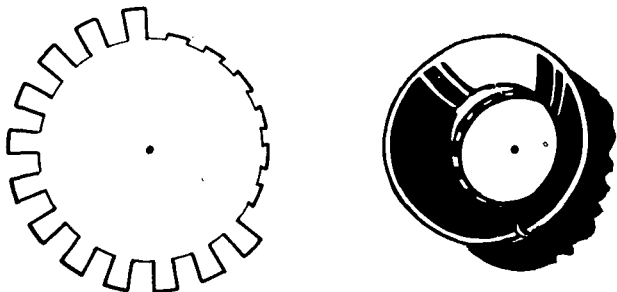


Figure 35. Parallax shield.

a rubber eyeguard, the fingers permit alinement within the guard without its removal.

c. *Procedure.* Steps to be followed are—

- (1) Insert the bore sights in the top left tube with the element containing the cross hairs in the end of the tube closest to the aiming circle.
- (2) Level the launcher trunnions as exactly as possible.
- (3) Sight through the bore sights and aline the aiming circle either in front or in rear of the launcher at a distance of 30 to 40 yards.
- (4) Set up the aiming circle, and with the scales set at zero, sight through the top left tube of the launcher.
- (5) Sight through the axis of the top left tube, and with the elevating and traversing mechanisms, aline the line-of-sight through the tube on the objective lens of the aiming circle exactly.
- (6) Recheck to insure that at zero setting the line of sight through the aiming circle is directly through the axis of the top left tube.

- (7) With the upper motion of the aiming circle turn to the telescope of the launcher.
- (8) With the telescope of the launcher turn to the lens of the aiming circle.
- (9) Recheck to insure that lines of sight through both the aiming circle and the telescope are centered exactly on the objective lenses of the instruments to which they point.
- (10) The deflection reading on the aiming circle is announced.
- (11) If the deflection announced does not agree with the deflection set on the sight, loosen the azimuth micrometer slipping clamp and slip the azimuth micrometer scale to the announced deflection.
- (12) Tighten the clamp and verify the adjustment.

Section III. BASIC PERIODIC TESTS

47. General

Basic periodic tests are performed by the section under the supervision of the platoon commander and the artillery mechanic. These tests are performed at the discretion of the unit commander. Suggested times for performance are: Once each year if the launcher is used only for nonfiring training; once every 3 months if the launcher is fired; as soon as possible after extensive use, accidents, or traversing extremely rough terrain; and whenever the launcher fires inaccurately for no readily apparent reason. The tests reveal whether or not the on-carriage sighting equipment and the gunner's quadrant are in correct adjustment. For the on-carriage equipment to

be in correct adjustment, the following conditions must exist:

a. The line of sight of the telescope must be parallel to the axis of the tubes.

b. Mounts and instruments are securely attached and there is no binding or excessive backlash between gears.

c. With the trunnions level, cluster leveled, and both bubbles leveled, all scales read zero and all indexes are matched.

d. The sighting equipment must satisfactorily meet all tests described in paragraphs 48 and 49.

e. Prior to all tests of on-carriage fire control equipment it is desirable that the trunnions be as level as possible. This may be checked by tracking a plumb line (par. 42) or by use of the gunner's quadrant as described in paragraph 34.

48. Test of Gunner's Quadrant

a. *General.* The gunner's quadrant must be in proper adjustment before conducting tests and adjustments of other sighting and fire control equipment. Inspect the shoes of the gunner's quadrant for dirt, nicks, or burrs. Similarly, inspect the leveling surface on the upper surface of the top left tube. Dirt, nicks, or burrs on these surfaces will cause the instrument to give inaccurate readings.

b. *End-for-End Test.*

- (1) Set both the index arm and micrometer scale of the gunner's quadrant at zero, making sure the auxiliary indexes match.
- (2) Place the quadrant on the leveling surface of the top left tube, the line-of-fire arrow pointing toward the front, and center the

quadrant bubble by turning the elevating handwheel.

- (3) Reverse the quadrant on the leveling surface (turn it end-for-end). If the bubble re-centers, the quadrant is in adjustment and the test is completed.
- (4) If the bubble does not recenter, try to center it by turning the micrometer knob.
 - (a) If the bubble centers, read black figures and divide by two. This is the correction.
 - (b) Place correction on micrometer and level cluster using elevation handwheel.
 - (c) Check by again reversing the quadrant. Bubble should center.
- (5) If bubble does not center as in (4) above, move the arm down one graduation (10 mils).
 - (a) Turn micrometer until bubble centers.
 - (b) Take reading on micrometer, add 10 to it and divide sum by 2.
 - (c) Place this reading on micrometer leaving the arm at minus 10; level cluster with elevation handwheel.
 - (d) Check by reversing quadrant on leveling surface. Bubble should center.
 - (e) Quadrant should be sent to an ordnance unit if correction of error amounts to more than plus or minus 0.4 mil.

c. Micrometer Test.

- (1) Set the index arm to read 10 mils on the graduated arc and set the micrometer scale at zero.

- (2) Place the quadrant on the leveling surface atop the cluster, the line-of-fire arrow pointing toward the front, and center the quadrant bubble by elevating the cluster.
- (3) Set the index arm at zero on the graduated arc and turn the micrometer one revolution to read 10 mils.
- (4) Reseat the quadrant on the leveling surface. The bubble should center.

Caution: Do not disturb the laying of the cluster.

- (5) If the bubble does not center, the micrometer is in error and must be adjusted by ordnance personnel.

d. Comparison Test. Compare readings taken at low, medium, and high elevations with all of the gunner's quadrants of a platoon on a *single* launcher that has been accurately cross leveled. Any quadrant differing from the average by more than 0.4 mil at any elevation should be sent to an ordnance unit for adjustment.

e. Correction. When a gunner's quadrant requires a correction as determined by the end-for-end test, this correction is not carried during firing but is applied only when making sight tests and adjustments.

49. Test of Telescope and Mount

a. General. The purpose of this series of tests is to determine whether the fire control equipment correctly transmits the motion of the cluster to the line of sight through the telescope at all elevations. They check the adjustment and mounting of the various fire control components and reveal whether the

launcher operates within prescribed tolerances. Test *b* (below) may be performed with the trunnions either level or canted. It is a general test that reveals total errors of the entire mechanism. Because compensating errors of various parts of the mount may result in the launcher testing out properly with test *b*, the other tests specified in *c* through *f* should be performed regardless of the result of test *b*. Total errors discovered by test *b* may then be reduced to errors in specific parts.

b. General Test of Telescope Mount.

- (1) With the bore sights in place in the top left tube, the cluster near zero elevation, and the plumb line (par. 42) suspended in front of the top left tube; traverse so the line of sight through the tube is on the plumb line.
- (2) Level the telescope mount in both directions by centering both the cross-level and longitudinal-level bubbles.
- (3) Place the intersection of the reticle hairs of the telescope on a sharply defined aiming point near deflection 2800 and note the deflection set.

Note. If longitudinal displacement of the sight is necessary to place it on the aiming point, it is obtained by rotating the telescope in the holder bracket so the level of the bubbles is not disturbed.

- (4) Elevate the cluster from zero to maximum elevation (or limit of the plumb line) in 100 mil steps. At each step, traverse the weapon (if necessary) to bring the line of sight through the top left tube back on the plumb line. If the line of sight through the tube tracks the plumb line at all eleva-

tions, the trunnions are level. If it is necessary to traverse to bring the line of sight back to the plumb line, the trunnions are not level.

- (5) After placing the line of sight through the top left tube back on the plumb line relevel the bubbles at each 100 mil elevation and check for deviation of the line of sight from the aiming point. If the vertical line is off the aiming point, it is brought to the aiming point by turning the azimuth micrometer knob and the deviation is measured on the azimuth micrometer. If the horizontal line is off, it is brought to the aiming point with the elevation micrometer knob and the longitudinal-level bubble displacement is noted.
- (6) If the vertical line deviates from the aiming point by more than $1\frac{1}{2}$ mils from the original deflection at any elevation tested, or if the correction for the deviation of the horizontal line causes the longitudinal-level bubble to travel in excess of one vial graduation, some component of the on-carriage fire control equipment is out of adjustment. The weapon must be referred to authorized ordnance maintenance personnel for adjustment or correction.

c. Cross-Level Test.

- (1) If the trunnions are not level, as noted in *b(4)* above, level them, removing soil from beneath one wheel if necessary, so that the line of sight through the top left tube tracks the plumb line at all elevations.

- (2) Center the longitudinal-level bubble.
- (3) Center the cross-level.
- (4) Elevate the cluster to maximum elevation keeping the longitudinal-level bubble leveled, noting the cross-level bubble.
- (5) If the cross-level bubble does not remain centered within one vial graduation, either the telescope mount is misaligned or the cross-level vial is incorrectly set. Refer the mount to authorized ordnance personnel for adjustment.

d. Longitudinal-Level Test.

- (1) Level the cluster longitudinally with the gunner's quadrant.
- (2) Center the longitudinal-level bubble.
- (3) Operate the cross-leveling knob throughout the limits of motion; the longitudinal-level bubble should remain centered within one vial graduation. If the bubble moves in excess of the tolerance, either the level vial or the sight mount is not aligned correctly and the launcher should be sent to an ordnance unit for adjustment.

e. Telescope Mount Alinement Test.

- (1) With the cluster level center the cross-level bubble.
- (2) Without elevating or traversing the cluster, operate the elevation micrometer knob throughout the limits of motion, noting the cross-level bubble.
- (3) If the cross-level bubble does not remain centered within one vial graduation, either the mount is misaligned or the cross-level vial is incorrectly set. Refer the mount to

authorized ordnance personnel for adjustment.

f. Elevation Mechanism Test.

- (1) Level the cluster longitudinally with the gunner's quadrant.
- (2) Level cross-level and longitudinal-level bubbles.
- (3) Check to see that the elevation scale and elevation micrometer read zero.
- (4) Repeat this check of quadrant settings against quadrant elevation settings at low, medium, and high angles of elevation.
- (5) If the elevation scale does not agree with the elevation set on the gunner's quadrant within $1\frac{1}{2}$ mils at any of the elevations compared, the launcher should be sent to an ordnance unit for adjustment.

50. Ordnance Check

It is not contemplated that using units will have the necessary facilities, tools, or skilled mechanics to perform the more precise tests and adjustments of sighting and fire control equipment. When deficiencies recur or when defects cannot be corrected in the field, ordnance checks should be scheduled.

CHAPTER 8

MAINTENANCE AND INSPECTION

51. General

Maintenance and inspection is essential to insure that the section is prepared to carry out its mission. Systematic maintenance and inspection drills provide the best insurance against unexpected breakdown at the critical moment when maximum performance is essential.

52. Disassembly, Adjustment, and Assembly

Disassemblies and adjustment of the weapon authorized to be performed by battery personnel are prescribed in TM 9-392A, supplemented by instructions contained in Department of the Army Supply Manuals. No deviation from these procedures is permitted unless authorized by the responsible ordnance officer.

53. Records

a. The principal records pertaining to the weapon are the Artillery Gun Book (OO Form 5825), a field report of accidents (SR 385-310-1), the "Unsatisfactory Equipment Report" (DA Form 468), and "Preventive Maintenance Roster" (DA Form 460). Information on the purpose and use of these records may be found in the forms themselves.

b. The chiefs of sections, platoon commander, battery executive, and battery commander should keep

semipermanent records on their weapons for their information and guidance.

54. Maintenance

For detailed instructions concerning maintenance of the 4.5-Inch Multiple Rocket Launcher M21, see TM 9-392A and the lubrication order for the weapon. For detailed instructions concerning maintenance of the vehicle being used as a prime mover, see the technical manuals and lubrication orders pertaining to that vehicle.

55. Inspections

Regular inspections are required to insure that materiel is maintained in serviceable condition.

a. The chief of section is responsible for the equipment within his section. He should inspect it thoroughly each day. If he sees the need for repair or adjustment, he notifies the platoon commander immediately so that the necessary action may be taken.

b. The platoon commander, accompanied by the artillery mechanic, should make a daily spot check inspection. Each day they should inspect different parts of the weapons to insure complete coverage every few days. At least once a month the executive and platoon commander make a thorough mechanical inspection of weapons, auxiliary equipment, tools, and spare parts.

c. Battery, battalion, and higher commanders should make frequent command inspections to assure themselves that the equipment in their commands is being maintained at prescribed standards of condition, appearance, and completeness.

d. For details on inspecting the 4.5-inch launcher, see TM 9-392A. For details on inspecting the vehicle

being used as a prime mover, see the appropriate technical manual for that vehicle. Deficiencies found during inspections should be corrected promptly.

e. Duties of individuals in performing the necessary inspections and maintenance of the gun are outlined in paragraphs 56 through 61. Work must be made routine, thorough, and rapid by following the drill outlined in these paragraphs. When the section is reduced in strength, the chief of section must reassign duties to insure that all maintenance steps are completed.

56. Duties in Inspection Before March

The inspection performed before operation is a final check on materiel prior to leaving the motor park for training in the field, the bivouac area for combat, or before displacement. After inspection, and when all deficiencies have been corrected, the section is ready to go into action. Responsibilities and duties of section personnel are as follows:

a. Chief of Section.

- (1) Commands **PERFORM BEFORE MARCH INSPECTION**. Supervises inspections by members of the gun section in all sequences.
- (2) Verifies that launcher is properly coupled and equipment installed.
- (3) Verifies that the parking brakes are released.
- (4) Verifies presence of proper supply of gasoline, oil, water, and emergency rations.
- (5) Verifies presence of technical manuals and lubrication orders for prime mover and launcher, trip ticket, driver's accident re-

port form, vehicle identification card, and gun book.

- (6) Inspects loading of section equipment for completeness and security.
- (7) Inspects ammunition for lot number, condition, and stowage.
- (8) Receives reports of personnel of his section upon completion of their duties in inspection.
- (9) Reports to platoon commander when section personnel have completed their duties, "Sir, No. (so-and-so) in order," or reports any defects which the section cannot remedy without delay.

b. Gunner.

- (1) Assisted by No. 1 removes the overall cover.
- (2) Inspects condition, completeness, and security of contents of the control box.
- (3) Verifies that the elevating lock is engaged.
- (4) Checks to see that the right parking brake is released.
- (5) Assisted by No. 1 replaces the overall cover and assures himself that all fastenings are secured.
- (6) Reports, "Gunner ready."

c. No. 1.

- (1) Assists gunner in removing the overall cover.
- (2) Verifies presence and security of rocket retaining pins.
- (3) Verifies that the traveling lock is engaged.
- (4) Checks to see that the left parking brake is released.

- (5) Assists gunner to replace overall cover.
- (6) Reports, "No. 1, ready."
- d. *No. 2.*
 - (1) Checks to see that drawbar is locked securely.
 - (2) Verifies that lunette is secure in pintle and that pintle latch is closed and locked.
 - (3) Verifies presence and security of trail stake on right of trail.
 - (4) Reports, "No. 2, ready."
- e. *No. 3.*
 - (1) Verifies presence and security of aiming post set and bore brush staff on left of trail.
 - (2) Verifies that blackout system is installed and functions, and that the blackout lamp is secure.
 - (3) Checks air pressure and condition of tires.
 - (4) Reports, "No. 3, ready."
- f. *Driver.*
 - (1) Performs *before operation* duties as prescribed in TM 21-305, assisted by other personnel of the section when so directed by the chief of section.
 - (2) Reports, "Driver, ready."

57. Duties in Inspection During March

The inspections performed during march are constant checks on the operation of the materiel and the security of all the stowed equipment. There is no command for this inspection as it is carried on constantly. The responsibilities and duties of section personnel are as follows:

a. *Chief of Section.*

- (1) Supervises march discipline.

- (2) Assigns duties for antiaircraft and anti-mechanized security.

b. Gunner.

- (1) Listens for abnormal or unusual noises, and observes towed load for security. Signals chief of section in case of malfunction.
- (2) Observes carried load and personal impedimenta for security.

c. Nos. 1 to 3.

- (1) Perform duties as antiaircraft and anti-mechanized security sentries as assigned by chief of section.
- (2) Listen for abnormal or unusual noises indicating malfunction of vehicle or launcher.

d. Driver. Performs *during operation* duties as prescribed in TM 21-305.

58. Duties in Inspection During the Halt

Inspection at the halt is made to insure that the launcher and prime mover are in satisfactory operational condition. This inspection checks items which cannot be checked during the march and is performed as soon as a halt is made. The chief of section, on being told length of halt, will divide halt time between relief and maintenance. The responsibilities and duties of section personnel are as follows:

a. Chief of Section.

- (1) Commands PERFORM HALT INSPECTION. Supervises inspection and maintenance at halt. Insures that personnel remain on the off-road side of the vehicle except for performance of necessary inspection duties.

- (2) Receives reports of personnel upon completion of their duties.
- (3) Reports to platoon commander when inspection is completed, "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.

b. Gunner and No. 1.

- (1) Inspect tires and wheels of launcher. (Inspect tires for valve caps, wear, bruises, cuts, stones in treads, and for correct air pressure. Inspect wheels for loose or missing nuts, hub cap screws, and for overheated bearings.)
- (2) Report in turn, "Gunner, ready," "No. 1, ready."

c. No. 2.

- (1) Inspects coupling of launcher to prime mover.
- (2) Verifies presence and security of trail stake on right of trail.
- (3) Assists driver in inspection of vehicle unless directed otherwise by chief of section.
- (4) Reports, "No. 2, ready."

d. No. 3.

- (1) Inspects connection and mounting of blackout light system.
- (2) Verifies presence and security of aiming post set and bore brush staff on left of trail.
- (3) Reports, "No. 3, ready."

e. Driver.

- (1) Performs *at halt* duties as prescribed by TM 21-305, assisted by No. 2 unless directed otherwise by the chief of section.
- (2) Reports, "Driver, ready."

59. Inspection Duties Prior To and During Firing

Inspection before and during firing is a continuing inspection to insure proper functioning of materiel. No command is necessary; each member of the section performs appropriate inspections before and during firing as shown below.

a. Chief of Section.

- (1) Supervises and commands section.
- (2) Insures proper handling and preparation of ammunition.

b. Gunner.

- (1) Checks operation of elevating and traversing mechanisms. Cleans and lubricates as required.
- (2) Cleans live electrical contacts in the tubes, assisted by No. 1.
- (3) Tests circuit using battery power as described in TM 9-392A to be sure that the batteries have sufficient power for firing in event of generator failure.
- (4) Tests and adjusts sighting and fire control equipment.
- (5) Installs instrument light batteries and sees that lamp lights.

c. No. 1

- (1) Assists gunner to clean live electrical contacts.
- (2) Checks fuze wrench for condition. While preparing ammunition, pays particular attention to inspection of the fuze threads and cavities in the rocket heads.

d. No. 2.

- (1) While preparing ammunition for firing, carefully examines the rockets to see that the plastic closing disk is in place, and that rockets are free of foreign matter, moisture, or grease.
- (2) Performs such other duties as assigned by the chief of section.

e. No. 3.

- (1) Cleans and dries rocket cluster tubes as described in TM 9-392A.
- (2) Installs aiming post light batteries and sees that lamps light.
- (3) Performs such other duties as assigned by the chief of section.

f. Driver. The driver, unless directed otherwise by the chief of section, moves his vehicle to the truck park where he performs *after operation* duties as prescribed in TM 21-305.

60. Inspection Duties and Maintenance After Operation

After operation, the gun is immediately given whatever servicing and maintenance is needed to prepare it in every way for further sustained action or to determine the need for maintenance by higher echelons. These operations may be performed in the motor park, bivouac area, or combat position. Responsibilities and duties of section personnel are as follows:

a. Chief of Section.

- (1) Commands **PERFORM AFTER OPERATION INSPECTION**. Supervises de-

tailed inspection and maintenance of gun in all sequences.

- (2) Inspects tools, accessories, and equipment for completeness and condition.
- (3) Inspects ammunition for lot number and condition.
- (4) Verifies the presence of and makes current entries in gun book, trip ticket, and other required documents.
- (5) Verifies supply of emergency rations, oil, water, and gasoline.
- (6) Receives reports from members of the section as they complete inspection and maintenance operation.
- (7) Reports to platoon commander when section personnel have completed their duties, "Sir, No. (so-and-so) in order," or reports any defects which the section cannot remedy without delay.

b. Gunner.

- (1) Removes overall cover, assisted by No. 1.
- (2) Cleans optical parts of telescope as prescribed in TM 9-392A.
- (3) Cleans and oils elevating arc.
- (4) Checks control box for cleanliness, completeness, and arrangement of contents.
- (5) Replaces overall cover, assisted by No. 1.

c. No. 1.

- (1) Assists gunner to remove overall cover.
- (2) Examines bellows for cracks and holes.
- (3) Lubricates at all oiler lubrication points in vicinity of cluster, trunnions, elevating and traversing controls, and axle according to lubrication chart.

- (4) Assists gunner to replace overall cover.

d. No. 2.

- (1) Lubricates at all oiler points in vicinity of drawbar.
- (2) Cleans trail and wheel stakes.
- (3) Inspects tires and wheels of launcher for damage and loose and missing parts; tests air pressure of tires and corrects it if necessary.
- (4) Assists driver in inspections and maintenance unless directed otherwise by chief of section.

e. No. 3.

- (1) Takes staff section from trail, bore brush from control box, assembles them and cleans and oils the tubes of the rocket cluster.
- (2) Inspects staff section and bore brush, performs necessary maintenance, returns them to case and control box respectively.
- (3) Takes aiming posts from case, inspects them and performs any necessary maintenance. Returns them to case.
- (4) Inspects blackout light system for operation and wear.
- (5) Refastens aiming posts and staff section on trail and installs blackout light system.

f. Driver. Performs *after operation* duties as prescribed in TM 21-305, assisted by No. 2 when available.

61. Duties in Weekly Inspection and Maintenance

In garrison these duties are performed weekly. On maneuver or in combat they are performed after

each field operation as prescribed in TM 9-392A and the lubrication order for the launcher.

a. Chief of Section.

- (1) Supervises section in weekly inspection and maintenance of launcher, tools, accessories, and equipment.
- (2) Obtains assistance of battery mechanic for supervision of any necessary authorized disassembly and maintenance.

b. Gunner and Nos. 1 to 3. Perform normal inspection of launcher, tools, accessories and equipment and lubrication schedule set forth in TM 9-392A as directed by the chief of section.

c. Driver. Assists the motor mechanic in the performance of the prescribed vehicle weekly inspection and maintenance unless directed otherwise.

CHAPTER 9

DECONTAMINATION OF EQUIPMENT

62. General

Equipment that has been contaminated by chemical, biological, or radiological agents constitutes a danger to personnel. *Contamination* means spreading of an injurious agent in any form and by any means. Persons, objects, or terrain may be contaminated. *Decontamination* is the process of making any contaminated place or object safe for unprotected personnel. This can be done by covering, removing, destroying, or changing into harmless substances the contaminating agent or agents. Generally, only equipment contaminated by persistent agents need be decontaminated.

63. Decontamination for Chemical Agents

a. Ammunition. With rags, wipe off visible contamination from rockets. Apply DANC (decontamination agent, noncorrosive, M4), wipe with gasoline-soaked rag, then dry. If DANC is not available, scrub with soap and cool water. Slurry (equal weights of water and chloride of lime) can be used on contaminated ammunition containers, but it must not be allowed to penetrate to the ammunition itself.

b. Instruments. If exposed to corrosive gases, clean instruments as soon as possible with alcohol

(or gasoline, if no alcohol is available), and apply a thin coat of light machine oil. A rag dampened with DANC may be used, followed by drying with a clean rag and then applying a coat of machine oil. DANC damages plastic or hard rubber surfaces.

c. Weapons. Remove dirt, dust, grease, and oil. Do not apply wet mix but allow surfaces to air after soil and dirt have been removed. DANC can be used on all metal surfaces, except the lands and electrical contacts. Also effective on metal are hot water, cleaning solvent, or repeated applications of gasoline on swabs. If the emergency use of gasoline-soaked swabs is made (FM 21-40), extreme care must be taken to insure that the gasoline does not spread the contamination and that no gasoline in liquid or vapor form remains. This excess would be ignited when the launcher is fired. Do not use DANC or gasoline to clean the bellows. After decontamination, weapons are dried and oiled.

d. Automotive Equipment. Light contamination from spray can be neutralized by exposure to air. For heavier contamination use DANC on interior or exterior surfaces that personnel are likely to touch. For larger area decontamination, wash vehicle with water and scrub painted surfaces with soap and water.

64. Decontamination for Biological and Radiological Agents

a. General. After a contaminating attack, recovery of equipment may be achieved either by waiting, to permit the decay of contamination, or by active decontamination, to reduce danger to a level where it is no longer a significant hazard to operating per-

sonnel. Decontamination may be either rough or detailed, depending on the urgency of the military situation. The procedure adopted will be a command decision.

b. Rough Decontamination. Rough decontamination is performed when urgency is the main factor. Its purpose is to reduce contamination sufficiently to permit personnel to work with, or close to, equipment for limited periods. Rough decontamination may be achieved by means of water or steam if available. Soap or other detergent used in conjunction with water or steam aids in decontamination.

c. Detailed Decontamination. Detailed decontamination, in which the emphasis is on thoroughness, will be carried out in rear areas and repair bases and includes procedures of surface decontamination, aging and sealing, and disposal.

65. References

For further information on decontamination see FM 21-40, TM 3-220, and TF 3-1407.

CHAPTER 10

DESTRUCTION OF EQUIPMENT

66. General

a. Tactical situations may arise in which it is necessary to abandon equipment in the combat zone. In such a situation all abandoned equipment must be destroyed to prevent its use by the enemy.

b. *The destruction of equipment subject to capture or abandonment in the combat zone will be undertaken only upon authority delegated by a division or higher commander.*

c. All batteries must prepare plans for destroying their equipment in order to reduce the time required should destruction become necessary. The principles to be followed are:

- (1) Plans for destruction of equipment must be adequate, uniform, and easily carried out in the field.
- (2) Destruction must be as complete as the available time, equipment, and personnel will permit. Since complete destruction requires considerable time, priorities must be established so that the more essential parts are destroyed first.
- (3) The same essential parts must be destroyed on all like units to prevent the enemy from constructing a complete unit from damaged ones.

- (4) Spare parts and accessories must be given the same priorities as the parts installed on the equipment.

67. Methods

To destroy equipment adequately and uniformly, all personnel of the unit must know the plan and priority of destruction and be trained in the methods of destruction.

68. References

For detailed information on destruction of the 4.5-inch multiple rocket launcher and fire control equipment, see TM 9-392A ; for ammunition, see TM 9-1901 and TM 9-1950. For destruction of the prime mover, see the TM appropriate to the vehicle being used as the prime mover.

CHAPTER 11

SAFETY PRECAUTIONS

69. General

Safety precautions to be observed in training are prescribed in SR 385-310-1. Additional information is found in FM 6-140, TM 9-392A, TM 9-1900, and TM 9-1950. The more important safety precautions are summarized in the following paragraphs.

70. Ammunition

a. All ammunition at the firing position must be placed so that it is protected from the backblast of the launcher and from explosion in case of accident at the position. Flames and explosive materials such as gasoline must be kept away from the ammunition. Ammunition should be protected from direct rays of the sun by use of a tarpaulin or other suitable covering.

b. Battery personnel must not attempt to disassemble fuzes.

c. In handling and storage, complete rockets should at all times be kept pointed in the direction that would result in the least damage should the propellant be accidentally ignited, preferably nose down or toward a barricade (TM 9-1950). Rocket components ordinarily will be stored as shipped.

d. All rockets not fired that have been prepared for firing must be checked by the chief of section to

insure that they are restored to their original condition and packing, and marked for priority of use in order that opened packages will be kept to a minimum. Such ammunition will be used first in subsequent firings.

71. Failure to Fire

Caution must be observed in removing a rocket that failed to fire. Since the failure may be merely a delay in the functioning of the propelling charge explosive train, *hangfire*, there should not be an immediate removal of the rocket. The rocket must not remain too long in the launcher, however, because there is danger that a very hot weapon may cause any or all explosive components of a chambered rocket to function, *cook-off*. (For further information on hangfires, cook-offs, and misfires, see TM 9-392A.) For removing a rocket the following definite intervals for waiting after failure to fire and additional attempts to fire have been established on the basis of experience and characteristics of the weapon:

a. After a failure to fire, actuate the firing switch two additional times in attempts to fire.

b. If the launcher still fails to fire, wait 15 seconds from the last attempt to fire, then check the electrical circuit for breaks, shorts, and poor contacts before another attempt to fire.

c. After making any necessary adjustments, again actuate the firing switch three times.

d. If the launcher still fails to fire, wait 15 seconds after the last attempt to fire before again checking the electrical circuit.

e. After making any other necessary adjustments, again actuate the firing switch three times in attempts to fire.

f. If the launcher still fails to fire, wait 15 seconds and remove the rocket as prescribed in paragraph 37. It is considered to be at fault unless upon examination a defective electrical circuit not previously detected is found.

g. During the operations described in *a* through *f* above, the launcher will be trained on the target and all personnel will stand clear of the muzzle and the path of the backblast.

h. The unloaded rocket will be kept separate from other ammunition until the cause of failure to fire is determined. If the rocket is at fault it will be kept separate until disposed of. If the firing switch is found to be at fault, the rocket may be reloaded and fired after correction of the faulty firing switch.

72. Drill and Firing

a. The launcher is kept unloaded except when firing is imminent.

b. The area ahead and behind the launcher will be clear of personnel, equipment, and inflammable material by a distance of 50 yards and at least 50 feet from each side of the launcher before the firing switch safety plug is installed. The danger zone is shaped like a triangle beginning at the launcher, and fanning out to a width of 50 yards at a distance of 50 yards back of the weapon.

c. In training there must always be a safety officer for each artillery unit firing. For duties of the safety officer, see FM 6-40.

CHAPTER 12

TRAINING

Section I. GENERAL

73. Purpose and Scope

The purpose of this chapter is to present the absolute minimum requirements for training the personnel of a launcher section in the performance of their duties in service of the launcher. It includes general information on the conduct of training, a minimum training schedule, and a test to be given for the qualification of gunners.

74. Objectives

The objectives are speed in training rocketeers in their individual duties; and, through drill, to weld them into an effective, coordinated team able to function efficiently in combat. During training, supervisors may well keep in mind the proficiency sought by Army Training Test (ATT) 6-3. Maximum efficiency is attained through continuous drills.

75. Conduct of Training

a. Training should be conducted in accordance with the principles laid down in FM 21-5. Its goal should be standards set forth in FM 6-125, TM 6-605, SR 615-25-15, and SR 615-25-20.

b. In general, individual training is conducted by noncommissioned officers as far as practicable. Officers are responsible for training plans, for conduct-

ing unit training, and for supervising and testing individual training.

c. Throughout training, the application of prior instruction to current training must be emphasized.

d. A record of the training received by each individual should be kept. This may be done by each chief of section keeping a progress card for each man in his section. This card should show each period of instruction attended, tests taken, and remarks pertaining to progress. Progress cards should be inspected frequently by the platoon commander and the battery executive to make sure that they are being kept properly and to determine the state of training. *Requiring the chief of section to keep these records emphasizes his responsibility toward his section.*

e. The necessity for developing leadership and initiative in noncommissioned officers must be emphasized constantly throughout training.

76. Standards to be Attained

Each member of the launcher section should know the duties of all other members of the section and be able to perform efficiently in all positions. See paragraphs 80 through 92 for tests to be given for the qualification of gunners.

Section II. MINIMUM TRAINING SCHEDULE

77. General

The training schedule outlined in paragraph 79 is a guide to meet the minimum training requirements for personnel of a launcher section in subjects covered in this manual.

78. Individual Periods

a. Individual periods of training in service of the launcher should be arranged, along with other battery training, into a balanced training program, taking into consideration the basic principles of training.

b. In general, except for service practice, periods on any subject should not be longer than one hour. Periods of launcher drill should be for only one-half of an hour and should be conducted in a vigorous manner.

c. Periods of launcher drill should be preceded and followed by periods on subjects that will be logically related to the drill. For example, precede a period of launcher drill with a period of testing and adjustment of sighting and fire control equipment, and follow it with a period on inspection and maintenance drills. A period on aiming post displacement correction may come between two periods of gun drill.

d. TM 9-392A provides information on which to base periods of instruction on description, characteristics, and functioning of the launcher; familiarization with the launcher, including elevating mechanism, sighting and fire control equipment; and field maintenance and malfunction. These should be included in the battery training schedule, closely allied with the training in service of the launcher outlined in paragraph 79. Approximately 8 hours should be devoted to this instruction.

e. Additional service of the launcher training may be performed during battery training exercises.

79. Schedule

(Total hours 75)

C—conference; D—demonstration; PW—practical work.

Total Hours 75

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW.	1-----	Organization and composition of launcher section; general duties of individuals; formation of launcher section.	Pars. 4-8----	Launcher and prime mover.
C, D, PW.	1-----	Posts and posting of rocketeers; changing posts; mounting and dismounting.	Pars. 9-13---	Do.
C, D, PW.	2 (1 hr. periods).	Coupling and uncoupling; prepare for action and march order; movement of launcher by hand.	Pars. 14-19--	Do.
C, D, PW.	24 (one-half hr. periods).	Gun drill, duties in firing, indirect laying.	Pars. 20-24, 28, 30-34.	T/O&E equipment.
C, D, PW.	4 (one-half hr. periods).	Gun drill, duties in firing, direct laying.	Pars. 25-27--	Do.
C, D, PW.	8 (1 hr. and one-half hr. periods).	Testing and adjusting of sighting and fire control equipment.	Pars. 40-50--	Do.
C, D, PW.	2 (one-half hr. periods).	Aiming post displacement correction.	Par. 29-----	T/O&E equipment, blackboard and chalk.
C, D, PW.	4 (1 hr. periods).	Inspections and maintenance drills.	Pars. 51-61--	T/O&E equipment.
C, D, PW.	1-----	Decontamination of materiel.	Pars. 62-65--	Decontamination equipment, T/O&E equipment.

79. Schedule—Continued

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW	1-----	Destruction of materiel to prevent use by the enemy.	Pars. 66-68	Demolition and T/O&E equipment.
C, D-----	1-----	Safety precautions	Pars. 69-72	T/O&E equipment.
PW-----	16 (4 hr. periods).	Service practice, indirect laying.	Pars. 20-24, 28, 30-34.	Do.
PW-----	4-----	Service practice, direct laying.	Pars. 25-27	Do.
C, PW-----	6 (1 hr. periods).	Review and tests of subjects previously covered.	All previous references.	Do.

Section III. TESTS FOR QUALIFICATION OF GUNNERS

80. Purpose and Scope

This section prescribes the tests to be given in the qualification of gunners. The purposes of the tests are—

a. To provide a means of determining the relative proficiency of the individual artillery soldier in the performance of the duties of the gunner, 4.5-inch multiple rocket launcher. The tests are not to be used as a basis for determining the relative proficiency of batteries or higher units.

b. To serve as an adjunct to training.

81. General Instructions

a. Standards of Precision. The candidate will be required to perform the tests in accordance with the standards listed below:

- (1) Scale settings must be exact and matching indexes must be brought into coincidence.

- (2) Level bubbles must be exactly centered.
- (3) The vertical hair in the reticle of the telescope must be alined on the left edge of the aiming post or on exactly the same part of the aiming point or target each time the launcher is laid.
- (4) Final motions of azimuth and elevation setting knobs, as well as traversing and elevating handwheels, must be made in the appropriate direction. Final motion for setting scales is from the lower to the higher numbers. For elevation, the final motion of the handwheel should be in the direction of the more difficult movement. Final motion for traversing is from left to right. Final movement of the vertical hair of the telescope is from left to right.

b. Assistance. The candidate will receive no unauthorized assistance. Each candidate may select authorized assistants as indicated in the tests. In the event a candidate fails any test because of the fault of the examiner or any assistant, the test will be disregarded, and the candidate will be given another test of the same nature.

c. Time. The time for any test will be the time from the last word of the command to the last word of the candidate's report. The candidate may begin any test after the first word of the first command.

d. Scoring. Scoring will be conducted in accordance with the two subparagraphs *Penalties* and *Credit* under each subject. If a test is performed correctly, credit will be given in accordance with the subparagraph *Credit* under each subject. No credit will be allowed if conditions exist as specified in the

subparagraphs headed *Penalties*. No penalty will be assessed in excess of the maximum credit for each test.

e. Preparation for Tests. The launcher will be prepared for action and the candidate posted at the proper position corresponding to the test being conducted or as indicated in the subparagraphs entitled *Special Instructions*. The examiner will insure that the candidate understands the requirements of each test and will require the candidate to report "I am ready," before each test.

f. Qualification Scores. Minimum scores required for qualification in the courses are as follows:

<i>Individual Classification</i>	<i>Points</i>
Expert gunner-----	90
First-class gunner-----	80
Second-class gunner-----	70

82. Outline of Tests

Para-graph number	Subject	Number of tests	Points each	Maxi-mum credit
83	Direct laying, elbow telescope	4	2	8
84	Indirect laying, deflection only	18	2	36
85	Laying for elevation with elevation scale	3	2	6
86	Laying for elevation with gunner's quadrant	3	2	6
87	Displacement correction	2		6
	Part I	(1)	5	(5)
	Part II	(1)	1	(1)
88	Measuring site to the mask	1	4	4
89	Measuring elevation	1	4	4
90	Referring the launcher	1	5	5
91	Test and adjustment of sighting and fire control equipment	6		10
	Test 1	(1)	2	(2)
	Tests 2, 3, 4, and 5	(4)	1	(4)
	Test 6	(1)	4	(4)
92	Materiel	3	5	15

Total credit..... 100

83. Direct Laying, Elbow Telescope

a. Scope of Tests.

- (1) Four tests (two groups of two tests each) will be conducted in which the candidate will be posted as the chief of section and will be required to execute commands similar to those given in *c* below.
- (2) Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

- (3) The candidate will be tested in the duties of the chief of section.

b. Special Instructions.

- (1) A stationary target will be placed approximately 600 yards from the launcher.
- (2) The candidate will have a range card on which the elevation corresponding to the target range will be indicated.
- (3) The azimuth scales will be set at zero, elevation at 100, bubbles leveled, and index lines matched.
- (4) The candidate will be posted so that he has easy access to the sight.
- (5) The launcher will be pointed so that—
 - (a) A shift of approximately 30 mils will be required for tests 1 and 3.
 - (b) It will not be necessary to shift the trail for any of the four tests.
- (6) Laying at the termination of tests 1 and 3 will not be disturbed prior to beginning tests 2 and 4.
- (7) The examiner will announce the assumed direction of the movement of the target at the beginning of tests 1 and 3. The assumed direction of the movement of the target in test 3 will be opposite to that in test 1.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 and 3--	TARGET. THAT TRUCK. LEAD 5.	Sets elevation corresponding to target range (from range card). Centers longitudinal-level bubble. Sets 5-mil lead in appropriate direction on azimuth micrometer scale. Centers cross-level bubble Traverses launcher until vertical hair is on center of mass of target, then steps clear.
2 and 4--	RIGHT (LEFT) 4, ADD (DROP) 7.	Same as test No. 1 above.

d. *Penalties.* No credit will be allowed if, after each test—

- (1) Azimuth micrometer scale has not been set for correct lead in appropriate direction.
- (2) The matching lines on the telescope have been misaligned.
- (3) The elevation is not set correctly.
- (4) The bubbles are not level.
- (5) The vertical line in the telescope reticle is not on the center of the visible mass of the target.

e. Credit.

Time in seconds, exactly or less than---	18	21	24
Credit-----	2.0	1.5	1.0

84. Indirect Laying, Deflection Only

a. Scope of Tests. Eighteen tests (two groups of nine tests each) will be conducted in which the candidate will be posted as the gunner and will be required to execute commands similar to those given in *c* below. Tests 1 through 9 (and tests 10 through 18) will be executed as one series of commands.

b. Special Instructions.

- (1) Commands will not necessitate shifting the trail.
- (2) The examiner will select a suitable aiming point and identify it to the candidate prior to tests 5 and 14.
- (3) Launcher will be laid on aiming posts.
- (4) The command for new deflections for each test will be within the prescribed limits listed below. The examiner must insure that he does not give commands that exceed the limits of traverse of the launcher.

Test number	Maximum change (mils)	Minimum change (mils)
1 and 10	20	10
2 and 11	30	20
3 and 12	30	20
4 and 13	30	15
5 and 14	none	200
6 and 15	none	200
7 and 16	20	10
8 and 17	30	20
9 and 18	30	20

- (5) The launcher will be laid with correct settings at the conclusion of each test before proceeding with the next test.
- (6) Aiming posts will be set out at prescribed distances and deflection 2800 for these tests.
- (7) The examiner will designate the section number of the launcher to be used.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 and 10.	DEFLECTION 2780.	Sets deflection. Centers cross- and longitudinal-level bubbles. Traverses launcher until vertical hair is on left edge of aiming posts. Checks centering of bubbles. Relays if necessary. Calls "Ready" and steps clear.
2 and 11.	DEFLECTION 2807.	Same as test No. 1 above.
3 and 12.	DEFLECTION 2784.	Same as test No. 1 above.
4 and 13.	DEFLECTION 2819. At conclusion of test 4 (13) give CEASE FIRE, END OF MISSION. (No time considered for this operation.)	Same as test No. 1 above. Gunner relays launcher on 2800.
5 and 14.	AIMING POINT, CHURCH STEEPLE, REFER	Refers telescope to church steeple. Reads deflection and reports "No. 1, Deflection (so much)."

Test number	Examiner commands (for example)	Action of candidate
6 and 15.	COMMON DEFLECTION 2800.	Slips the azimuth micrometer scale to zero. Slips the index ring to 2800 on the outer azimuth scale. Verifies that vertical hair of the reticle is on the church steeple and that the bubbles are level. Calls "No. 1, Deflection 2800." Steps clear.
7 and 16.	DEFLECTION 2785.	Same as test No. 1 above except vertical hair is on aiming point.
8 and 17.	DEFLECTION 2812.	Same as test No. 1 above except vertical hair is on aiming point.
9 and 18.	DEFLECTION 2795.	Same as test No. 1 above except vertical hair is on aiming point.

d. Penalties.

- (1) No credit will be allowed if, after each test--
 - (a) The deflection is set incorrectly.
 - (b) The cross-level or longitudinal-level bubble is not centered.
 - (c) The vertical hair of the telescope is not on the aiming point or left edge of aiming posts, as the case may be.
- (2) No credit will be allowed if the last motion of the traverse was not made from left to

right and the traversing handwheel brake was not set.

e. Credit.

Time in seconds, exactly or less than--	-----	-----	-----
Tests 5, 14, 6, and 15 each-----	8	9	10
Other tests, each-----	13	14	15
Credit-----	2.0	1.5	1.0

85. Laying for Elevation With Elevation Scales

a. Scope of Tests. Three tests will be conducted in which the candidate will be posted as the gunner and will be required to execute commands similar to those given in *c* below.

b. Special Instructions.

- (1)) The elevation setting on the elevation scale prior to test No. 1 will be within 40 mils of the initial elevation for the test.
- (2) Each test will require a change of settings and the accompanying laying of the tube in elevation within the limits of 20 to 40 mils.
- (3) Commands for elevation for tests Nos. 2 and 3 will not be made in the multiples of 10 mils,

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1	QUADRANT ELEVATION 420.	Sets announced elevation. Centers cross-level and longitudinal-level bubbles. Calls "Ready" and steps clear.
2	QUADRANT ELEVATION 446.	Same as test No. 1 above.
3	QUADRANT ELEVATION 479.	Same as test No. 1 above.

d. Penalties.

(1) No credit will be allowed if, after each test—

(a) The elevation is set incorrectly.

(b) The cross-level or longitudinal-level bubble is not centered.

(2) No credit will be allowed if the last movement of the elevating handwheel was not made in the direction in which it is more difficult to turn the elevating handwheel and the elevating handwheel brake was not set.

e. Credit.

Time in seconds, exactly or less than—	6	7%	8%
Credit.....	2.0	1.5	1.0

86. Laying for Elevation With Gunner's Quadrant

a. Scope of Tests. Three tests will be conducted in which the candidate will be posted as the chief of section and will be required to execute commands similar to those given in *c* below.

b. Special Instructions.

- (1) The gunner's quadrant will be set at zero for the first test.
- (2) Each succeeding test will require a change of quadrant elevation setting within the limits of 30 to 60 mils.
- (3) The candidate will be posted with the gunner's quadrant in his hand.
- (4) An assistant, selected by the candidate, will be posted as the gunner to operate the elevating handwheel.
- (5) On models having no leveling surface an assistant may be selected to place and steady a leveling plate on the top left tube bosses in order that the gunner's quadrant may be held on the plate for measurements.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1	QUADRANT 180.....	Sets quadrant elevation on gunner's quadrant. Places quadrant on leveling surface or leveling plate. Has assistant elevate or depress the cluster until the quadrant bubble is centered. Calls "Ready" and waits for examiner to verify laying.
2	QUADRANT 240.....	Same as test 1 above.
3	QUADRANT 205.....	Same as test 1 above.

d. Penalties.

- (1) No credit will be allowed if, after each test—
 - (a) The quadrant elevation is set incorrectly.
 - (b) The quadrant bubble is not properly centered.
- (2) No credit will be allowed if the last movement of the tube was not in the direction in which it is more difficult to turn the elevating handwheel and the elevating handwheel brake was not set.

e. Credit.

Time in seconds, exactly or less than---	8	8 $\frac{3}{4}$	9
Credit-----	2. 0	1. 5	1. 0

87. Displacement Correction

a. Scope of Test. One test, consisting of two parts, will be conducted in which the candidate will be posted as the gunner and will be required to execute the commands given in *c* below.

b. Special Instructions.

- (1) Aiming posts will be set out at the prescribed distances.
- (2) An assistant, selected by the candidate, will be stationed close to the far aiming post.
- (3) The examiner will require the candidate to lay the launcher on an announced deflection and report "I am ready."
- (4) The far post or the launcher will then be moved so that a displacement of 5 to 10 mils occurs.
- (5) The laying of the launcher at the termination of part I will not be disturbed before beginning part II.

c. Outline of Test.

(1) Part I.

Examiner commands	Action of candidate
CORRECT FOR DIS- PLACEMENT.	Lays the launcher so that the far post appears midway between the near post and the vertical hair of the telescope. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.

(2) Part II.

Examiner commands	Action of candidate
ALINE AIMING POSTS.	Directs assistant in alining aiming posts. Calls "Ready" and steps clear.

d. Penalties. No credit will be allowed if—

(1) Part I.

- (a) The far aiming post does not appear midway between the near post and the vertical cross hair of the telescope.
- (b) The cross-level or longitudinal-level bubble is not centered.
- (c) The last motion of traverse was not made from left to right.

(2) Part II.

- (a) The deflection is other than the announced deflection.
- (b) The aiming posts are not properly alined.

(c) The vertical hair of the telescope is not on the left edge of the aiming posts.

e. Credit.

Part I, time in seconds, exactly				
or less than.....	3	3½	3¾	4
Credit.....	5. 0	4. 0	3. 0	2. 0
Part II, no time limit.....	----	----	----	----
Credit.....	1. 0	----	----	----

88. Measuring Site to Mask

a. Scope of Test. One test will be conducted in which the candidate will be posted as the chief of section and will be required to execute the command given in *c* below.

b. Special Instructions.

- (1) The launcher prepared for action, will be placed 200 to 400 yards from a mask of reasonable height.
- (2) The cluster will be elevated so that the tubes are 50 to 80 mils above the crest and 30 to 50 mils right or left of the highest point of the crest.
- (3) The candidate will take post directly in rear of the cluster.
- (4) An assistant, selected by the candidate, will be stationed at the post of the gunner.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE SITE TO MASK.	<p>Sights along lowest element of lowest center tube and has the gunner operate the elevating and traversing mechanism until line of sight just clears crest.</p> <p>Directs the gunner to center the longitudinal-level bubble by turning elevating knob and centers cross-level bubble.</p> <p>Moves to convenient position and reads elevation from elevation scale and micrometer.</p> <p>Reports "No. (so-and-so), site to mask (so much)."</p>

d. Penalties. No credit will be allowed if—

- (1) The line of sight along the lowest element of the lower center tube does not just clear crest.
- (2) The cross-level or longitudinal-level bubble is not properly centered.
- (3) The elevation scale reading is announced incorrectly.
- (4) The last movement of the tube was not in the direction in which it is more difficult to turn the elevating handwheel.

e. Credit.

Time in seconds, exactly or less

than.....	14	15	16	17
Credit.....	4.0	3.0	2.0	1.5

89. Measuring Elevation

a. Scope of Test. One test will be conducted in which the candidate will be required to measure the elevation by means of the gunner's quadrant.

b. Special Instructions.

- (1) Prior to the test the examiner will lay the cluster at a selected elevation, measure the elevation, and then set the gunner's quadrant at zero.
- (2) On models having no leveling surface on the top left tube an assistant is selected by the candidate to steady the leveling plate.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE THE ELEVATION	Places gunner's quadrant on leveling surface or leveling plate. Levels bubble by raising or lowering the index arm and turning the micrometer knob. Announces "No. (so-and-so), elevation (so much)," and hands quadrant to examiner.

d. Penalties. No credit will be allowed if—

- (1) The quadrant bubble is not centered when the quadrant is seated properly.
- (2) The elevation is announced incorrectly.

e. Credit.

Time in seconds, exactly or less than ---	8	9%	10%
Credit-----	4.0	3.0	2.0

90. Referring the Launcher

a. Scope of Test. One test will be conducted in which the candidate will be posted as the gunner and will be required to measure and report a deflection.

b. Special Instructions.

- (1) The launcher will be laid on aiming posts to the left front.
- (2) An aiming point within 200 mils to the left or right of the aiming posts will be designated by the examiner and identified by the candidate.

c. Outline of Test.

Examiner commands	Action of candidate
NUMBER (SO-AND-SO), AIMING POINT, THAT (SO-AND-SO), REFER	Centers cross-level and longitudinal-level bubbles. Refers to aiming point. Checks centering of bubbles and re-lays telescope if necessary. Reads deflection and reports, "No. (so-and-so), deflection (so much)" and steps clear.

d. Penalties. No credit will be allowed if—

- (1) The cross-level or longitudinal-level bubble is not centered properly.
- (2) The vertical hair of the telescope reticle is not on the aiming point.
- (3) The deflection is announced incorrectly.
- (4) The traversing handwheel is turned.

e. Credit.

Time in seconds, exactly or less than	5	5%	6	6%
Credit	5.0	4.0	3.0	2.5

91. Test and Adjustment of Sighting and Fire Control Equipment

a. Scope of Test. Five tests will be conducted in which the candidate will be required to demonstrate the methods employed in making the prescribed tests and adjustments, or describe the action taken (i. e., send to the ordnance maintenance company) if adjustment is not authorized to be made by using personnel.

b. Special Instructions.

- (1) The launcher will be prepared for the tests as indicated in paragraph 42.
- (2) The equipment that will be needed for the tests includes bore sights, testing target, and gunner's quadrant.
- (3) The candidate will select assistants who will operate the elevating handwheel at the direction of the candidate during tests 1 and 2 and adjust and aline the testing target at the direction of the candidate prior to test 5.
- (4) The tests will be conducted in the sequence indicated in *c* below. After completion of test 2, the gunner's quadrant used in tests 1 and 2 will be used for test 4, with the proper correction, as determined in test 1, carried on the quadrant, provided the correction does not exceed 0.4 mil.
- (5) Adjustment which the candidate may be required to accomplish will fall within the following limits:
 - (a) Elevation scale, not to exceed one 100-mil graduation.

(b) Elevation micrometer scale, not to exceed ten 1-mil graduations.

(c) Slipping azimuth micrometer scale, not to exceed ten 1-mil graduations.

c. Outline of Tests.

Test number	Examiner commands	Action of candidate
1	PERFORM END-FOR-END TEST ON GUNNER'S QUADRANT	Performs test as prescribed in paragraph 48. Calls "Correction (so many) mils, quadrant serviceable (unserviceable)" and hands quadrant to examiner for verification.
2	PERFORM MICROMETER TEST ON GUNNER'S QUADRANT	Performs test as prescribed in paragraph 48. Calls "Quadrant micrometer is (is not) in error" and states any further action that should be taken.
3	TEST LEVELS ON TELESCOPE MOUNT	Performs tests and makes adjustments, if necessary, as prescribed in paragraph 49c and d. Calls "Cross- (longitudinal-) level bubble(s) within (without) allowable limit."
4	TEST ELEVATION SCALE AND MICROMETER	Performs tests and makes adjustments, if necessary, as prescribed in paragraph 49e. Calls "Ready" and steps clear.

Test number	Examiner commands	Action of candidate
5	BORE SIGHT THE LAUNCHER	Bore sights as described in paragraph 44. Calls "Ready" and steps clear.

d. Penalties.

- (1) *General.* The tests are not essentially speed tests. The purpose of the prescribed time limits is to insure that the candidate can perform the operation without wasted effort.
- (2) *Test 1.* No credit will be allowed if—
 - (a) The bubble of the gunner's quadrant does not center when verified by the examiner.
 - (b) The necessary correction (one-half of the amount of the angle which was indicated when the quadrant was first reversed and the bubble centered by moving the index arm and micrometer) is announced incorrectly by the candidate.
 - (c) The candidate fails to declare the quadrant unserviceable if the necessary correction exceeds 0.4 mil, or fails to declare the quadrant serviceable if the necessary correction is 0.4 mil or less.
 - (d) The time to complete the test exceeds 2 minutes.

- (3) *Test 2.* No credit will be allowed if—
 - (a) The procedure is not followed correctly.
 - (b) The time to complete the test exceeds 1 minute.
- (4) *Test 3.* No credit will be allowed if—
 - (a) The candidate does not announce correctly in regard to the status of either the cross-level or the longitudinal-level bubble.
 - (b) The time to complete the test and adjustments exceeds 4 minutes.
- (5) *Test 4.* No credit will be allowed if—
 - (a) The procedure was not followed correctly and the elevation scales do not read zero when the cluster is leveled longitudinally with the gunner's quadrant.
 - (b) The candidate fails to announce the correct action if the elevation scales do not agree with the elevation set on the gunner's quadrant within $1\frac{1}{2}$ mils at any of the elevations compared.
 - (c) The time to complete the test and adjustments exceeds 3 minutes.
- (6) *Test 5.* No credit will be allowed if—
 - (a) The candidate fails to make any adjustment when such adjustment is indicated.
 - (b) The index lines on the telescope and the holder bracket are not matched.
 - (c) The elevation scale and micrometer do not read zero.
 - (d) The azimuth scales and the azimuth micrometer scale do not read zero.

- (e) The center line of the bore, as viewed through the bore sights, or the line of sight of the telescope do not fall on their respective aiming diagrams on the testing target when all scales are set at zero.
- (f) The time to complete the tests and adjustments exceeds 4 minutes and 30 seconds.

e. Credit.

- (1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.
- (2) If the tests and adjustments are performed correctly within the prescribed time limit, maximum credit will be given as follows:

Test 1	-----	2
Test 2	-----	1
Test 3	-----	1
Test 4	-----	2
Test 5	-----	4
<hr/>		
Total	-----	10

92. Materiel

a. Scope of Tests. The candidate will be required to perform two tests as outlined below.

b. Special Instructions.

- (1) *Test 1.* For test 1, the tools and accessories necessary for the performance of the test will be made readily available to the candidate prior to the start of the test.
- (2) *Test 2.*
 - (a) A complete set of lubrication equipment authorized for use of battery personnel

(b) Every type of lubricant used on the gun will be placed in plainly labeled containers conveniently on the paulin.

Test number	Examiner commands	Action of candidate
1	<p>DEMONSTRATE (a) INSERTING (REMOVING) SAFETY PLUG. (b) CHANGING FROM GENER- ATOR POWER TO BATTERY POWER. (c) TESTING FIR- ING CIRCUIT.</p> <p>EXPLAIN (a) PROCEDURE TO BE FOL- LOWED IN EVENT OF MIS- FIRE. (b) DESTRUCTION PROCEDURE.</p>	<p>Performs the operations as described in TM 9-392A.</p> <p>Explains the procedures indicated in paragraph 71.</p> <p>Explains the procedures indicated in TM 9-392A.</p>
2	PERFORM DAILY, WEEKLY, AND MONTHLY LUBRICATION TEST.	Selects proper lubricating equipment and lubricant and tells how, when, and with which lubricant each lubrication point is serviced. (Actual lubrication is not performed.)

d. Penalties.

- (1) The tests are not essentially speed tests. The purpose of the maximum time limits is to insure that the candidate can perform the operations without wasted effort.
- (2) No credit will be given if the following time limits are exceeded:

Test 1_____ 5 minutes

Test 2_____ 6 minutes

- (3) A penalty of one point will be assessed for each component part of test 1 incorrectly demonstrated or explained.
- (4) A penalty of one-half of a point will be assessed for each lubrication point missed or lubricated improperly, and for each time the proper lubricating device or proper lubricant is not selected.

e. Credit.

- (1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.
- (2) A maximum credit of five points will be given for test 1 and a maximum of 10 points will be given for test 2.

APPENDIX

REFERENCES

1. Miscellaneous Publications

- AR 600-70 Badges.
- AR 750-5 Maintenance Responsibilities and Shop Operation.
- ATT 6-3 Field Artillery Rocket Battery and Battalion Tests.
- SR 110-1-1 Index of Army Motion Pictures, Kinescope Recordings, and Film Strips.
- SR 310-20-series Military Publications.
- SR 320-5-1 Dictionary of United States Army Terms.
- SR 320-50-1 Authorized abbreviations.
- SR 385-310-1 Regulations for Firing Ammunition for Training, Target Practice, and Combat.
- SR 615-25-15 Military Occupational Specialties.
- SR 615-25-20 Career Fields.
- FM 5-15 Field Fortifications.
- FM 5-20 Camouflage, Basic Principles.
- FM 5-20B Camouflage of Vehicles.
- FM 5-20D Camouflage of Field Artillery.
- FM 5-25 Explosives and Demolitions.
- FM 6-40 Field Artillery Gunnery.
- FM 6-101 The Field Artillery Battalion.

FM 6-125	Qualification Tests for Specialists, Field Artillery.
FM 6-140	The Field Artillery Battery.
FM 21-5	Military Training.
FM 21-8	Military Training Aids.
FM 21-30	Military Symbols.
FM 21-40	Defense Against Chemical Attack.
FM 25-10	Motor Transport.
TM 3-220	Decontamination.
TM 6-605	Field Artillery Individual and Unit Training Standards.
TM 9-392A	4.5-Inch Multiple Rocket Launcher T123.
TM 9-575	Auxiliary Sighting and Fire Control Equipment.
TM 9-850	Abrasive, Cleaning, Preserving, Sealing, Adhesive, and Related Materials Issued for Ordnance Materiel.
TM 9-1527	Ordnance Maintenance: Gunner's Quadrants M1 and M1918, and Machine Gun Clinometer M1917.
TM 9-1545	Ordnance Maintenance: Telescope Mounts, and Range and Elevation Quadrants for Motor Carriages, Field Artillery and Antiaircraft Artillery.
TM 9-6111	Ordnance Maintenance: Panoramic Telescopes, All Types.
TM 9-1900	Ammunition, General.
TM 9-1901	Artillery Ammunition.
TM 9-1950	Rockets.
TM 9-2300	Artillery Materiel and Associated Equipment.

- TM 21-300 Driver Selection and Training,
Wheeled Vehicles.
- TM 21-305 Driver's Manual.
- TM 9-2810 Tactical Motor Vehicle Inspections
and Preventive Maintenance Serv-
ices.
- T/O&E 6-87 Field Artillery Battery, 4.5-Inch
Rocket, Truck-Drawn.
- TF 3-1407 Decontamination Procedures.

2. DA ORD Supply Manuals

- 3 SNL R-1 Ammunition for Light Artillery.
- 3 SNL S-6 Ammunition Instruction Material
for Aircraft Bombs, Grenades,
Pyrotechnics, and Rockets.
- 3 SNL S-9 Rockets, All Types and Compon-
ents.
- 3 SNL R-3 Service Fuzes and Primers for Pack,
Light and Medium Field, Air-
craft, Tank, and Antitank Ar-
tillery.
- (*) SNL C-90 Launcher, Rocket, Multiple, 4.5-
Inch, T123.
- 3 SNL R-7 Land Mines and Fuzes, Demolition
Material, and Ammunition for
Simulated Artillery and Grenade
Fire.
- 3 SNL K-1 Cleansers, Preservatives, Lubri-
cants, Recoil Fluids, Special Oils,
and Related Maintenance Ma-
terials.

(*) See. ORD 1 for published manuals of the ordnance section of the Department of the Army Supply Manual.

- 3 SNL K-2 Items of Soldering, Metallizing, Brazing, and Welding Materials; Gases and Related Items.
- (*) SNL K-3 Lubricating Equipment, Accessories, and Related Dispensers.
- (*) SNL F-205 Light, Aiming Post, M14; Light Instrument M1, M2, M3, M4, M5, M6, M7, M8, M9, M10, M12, M13, M15, M16, M17, M18, M19, M20, M21, M22, M23, M24, M25, M26, M27, M28, M29, M30, M31, M32, M33, M34, M35, M36 (T10), M39C, T9, and T16.
- (*) SNL F-323 Mount, Telescope, M79.
- (*) SNL F-35 Posts, Aiming.
- (*) SNL F-140 Quadrant, Gunner's, M1 (mils).
- (*) SNL F-262 Telescope, Elbow, M62.

3. DA Forms

- DA Form 9-3 Processing Record for Shipment and Storage of Vehicles and Boxed Engines (Tag).
- DA Form 460 Preventive Maintenance Roster.
- DA Form 468 Unsatisfactory Equipment Report.
- DA Form 811 Work Request and Job Order.
- DA Form 811-1. Work Request and Hand Receipt.
- DA Form 867 Status of Modification Work Order.
- DD Form 6 Report of Damaged or Improper Shipment.

(*) See ORD 1 for published manuals of the ordnance section of the Department of the Army Supply Manual.

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